THE ELECTRICAL WORLD
A Weekly Review of Current Progress in Electricity and its Practical Applications

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,
167-177 TIMES BUILDING, NEW YORK.
Established 1874. Incorporated 1889.
W. J. JOHNSTON, Prest. C. E. STUMP, Treas. and Bus. M'g'r.
Telephone Call: Murray 586. Cable Address: "Electrical," New York.

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New England Office, 8 Cook Building, Boston.
Western Office, 39 Mallers Building, Chicago.
Philadelphia Office, 31 City Trust Building.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.
(Including Postage in the U. S., Canada or Mexico.)
IN CLUBS of four or more, $2.50 a year each; with a free extra copy to the getter up of a club of 8. Foreign subscription, $5 a year.

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ESTABLISHED 16 YEARS AGO, **THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the LARGEST CIRCULATION of any electrical periodical in the world, and is the BEST ADVERTISING MEDIUM.**

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VOL. XIII. NEW YORK, JUNE 29, 1889. No. 26.

CLOSE OF VOLUME XIII.

The present issue closes Volume XIII. of THE ELECTRICAL WORLD, a volume which in size, number of illustrations, variety and originality, and general excellence of its contents may fairly be claimed to have surpassed any of its predecessors. One or two of our contemporaries, for whom we have always entertained and expressed feelings of respect, have lately regarded themselves as called upon by Providence to chide us for our want of modesty in directing attention to the merits of this journal. We can only regret that the qualities of the paper forbid any greater display of modesty than we have hitherto indulged in. Perhaps the Index at the end of this number, for the half year, will be looked upon by our readers as some justification for the pride that we take, and they with us, in the prosperity and good work of THE ELECTRICAL WORLD.

Binding the "World" Volumes. MANY of the readers of THE ELECTRICAL WORLD are in the habit of binding up the advertisements as well as the reading matter of the paper. The practice has not a few recommendations, but the paper has now become so bulky that it is well nigh impossible to bind up a whole year together, complete. We shall be glad, therefore, to furnish free on application to all who wish it a title page for the half year volume now ending.

Gramophone Improvements. In another column we place before our readers notes on some improvements made by Mr. Berliner in his ingenious gramophone, by which both the time and the cost of operating are considerably reduced. Heretofore, it will be remembered, Mr. Berliner employed a high grade of zinc for the record plate. By the substitution of common sheet zinc, improvements in several directions are effected, bringing the gramophone one step nearer to perfection.

The Phonograph as Auctioneer. NEW uses for the phonograph suggest themselves daily. An ingenious application is that just made by an enterprising auctioneer in Brooklyn, who, in disposing of land at his periodical sales, has a phonograph to repeat the rules and conditions of sale. In this manner he saves his lungs, and the same matter can be gone over any number of times indefinitely, and at more than one sale. It seems to us that such a method ought to recommend itself to other professions where lungs and throat weariness is often felt.

The Debt of Science to Planté. THOSE who had learned to admire Planté for the high character of his work and the gentleness of his spirit cannot but experience a sentiment of delight and reverence on contemplating the noble method in which he has disposed of his property. With the fund he has given to endow a prize for original work in electrical research, a new impetus will be felt by the branch of science which he himself so greatly enriched by far-reaching investigations. To this fund, moreover, he added the establishment of a retreat for scientists, bequeathing his own home for that purpose. Such actions will but enhance his worthy fame.

Deep Sea Cable Manufacture. MR. H. L. WEBB discussed in our columns last week the prospects of deep sea cable manufacture in this country. He now follows the subject up by pointing out very clearly and fully the extent of the cable field and the strong foothold that England has in it. Perhaps there are insuperable obstacles to the entrance of America upon deep sea cable work, but Mr. Webb hardly thinks so. Now that we make telephones, switchboards, dynamos, motors and lamps for half the world, it does seem a little bit gratuitous and unpatriotic to believe that we have absolutely no mission at all in cable laying, especially when some of the cables now wanted are to land on our shores.

Legislation on Electric Lighting. WE receive from Mr. A. R. Foote at the hour of going to press, and thus too late for more extended notice, some printed matter relative to the work of the National Electric Light Association Committee of which he is the energetic chairman—that on State and Municipal legislation. It is satisfactory to find that already 19 gentlemen, out of 40 suggested, have consented to serve on the committee as representatives from their respective States or Territories. There is reason to believe that before many months have passed, every State will have a vigilant member watching and reporting the course of legislation. As Mr. Foote puts it in his appeal: "For the influence, prestige, and experience gained by you in your own State, the National Committee will give you in even exchange the influence, prestige and experience gained in 41 States." Mr. Foote also shows from the recent course of affairs in West Virginia and Missouri how the need for watchfulness and cooperation is felt. The movement is deserving of encouragement and support, and it is to be hoped that, with a completed committee at Niagara Falls, the Association will be able to meet its responsibilities in this important matter.

The Bangor Brush Plant. IN view of the interest now taken in the question of municipal plants for electric lighting, the excellent article from our New England correspondent, who made a special trip to be present at the Bangor opening last week, will be found timely. It will be noticed that there were at Bangor several reasons peculiar to the case, inducing the city to invest in such a plant. Now that a good selection of apparatus has been made, and the plant has been entrusted in excellent shape to safe hands, the service should be satisfactory; but we still see no reason for believing that a private company would not operate the system to greater advantage than the city authorities can. Possibly the local politics of Bangor are clean; but, if not, the plant will soon be made a means of jobbery and plunder, just as the gas-works were in Philadelphia, and as the water-works are to-day of most cities that the public have had an opportunity of looking into. One of these days we shall find the citizens of Bangor leasing the plant to a local company.

"Nationalism" in West Virginia. JUST now the founders of Nationalism are advocating control by city authorities everywhere of electric light and power plants, and it seems that Boston doctors of the creed have found willing disciples in West Virginia politicians. A bill has been actively pushed in the State named to give the city of Wheeling the fullest powers imaginable in regard to buying, owning and operating electric plants, and the measure would have passed but for the opposition of the Wheeling Electric Company, which, however, may have to renew the struggle during an extra session of the Legislature. No doubt it seems very wrong and sinful to the well meaning Nationalists that a company, started in all good faith under public guarantees, should seek to protect its property and franchises, but it is likely that the company has its own views on the subject, and may feel inclined to call spoliation and confiscation by their proper name.

New York Street Railways. THE bill recently signed by the Governor of this State, allowing the street railroad companies to substitute mechanical motive power for horses, is an important one. We hope in time to see it lead to a general use of electric motors on the roads in this city, but we apprehend that its first effect will be to encourage cable traction, for the reason that for some years past one or two roads have had their minds fixed on cables and will not be satisfied till they have given them a trial. The difficulty about the destruction of old and new street paving is, however, a serious one, and it may stand in the way of cable work on an extensive scale. The situation, in fact, is not an unfavorable one for electricity, and we expect to see it availed of for the introduction of one or other of the systems of electric traction. Boston has been setting New York a brilliant example in this respect, but it is still open to New York to bring itself abreast of the improvements of the day and hour in urban passenger traffic.

The Niagara Falls Convention. AS the time draws near for the convention of the National Electric Light Association at Niagara Falls, the arrangements are being vigorously pushed, and there is already promise of a most enjoyable and profitable gathering. The programme outlined by Mr. Garratt is an attractive one, and we hope it will have the effect of inducing a large attendance. It seems to us that, as before, there will be a fair representation from the larger towns and cities, but what is wanted is a more active participation of those who operate plants in places of moderate size. Such men constitute a large proportion of the personnel of the electric light industry. They not only have much to tell, but something to learn, and we know of no time at which they can better exchange experiences and ideas than during a convention, when almost every word uttered brings up some special point of importance and interest. The Association was formed for their benefit, and its prosperity cannot but affect their welfare closely. Its proceedings are followed with care by a large and intelligent public, and its deliverances on any question bear directly on the status of the business in general estimation, influencing, also, more even than is supposed, the action of municipal authorities, capitalists, economists, and other bodies and individuals with whom local companies have to deal. Considerations of this nature should, we think, weigh with all actively interested in electric lighting, and cause them to take part as members in the work of the association.

Invading New Brunswick. LAST week we took occasion to publish the programme of the festivities to be indulged in during the coming month at St. John, New Brunswick, to celebrate the union of that city with Portland, and to mark the completion of the Brunswickian link of the Canadian Pacific Railway. We are now glad to report that the electrical exhibition which it is proposed to hold in connection with the fete gives every promise of success at the hands of Mr. Knudson. A number of American firms and companies have already made arrangements to exhibit, and we trust that yet others will seize this opportunity to cultivate a new market by showing their goods or by going to St. John on a tour of personal inspection, thus combining business with pleasure in a happy way. The conditions for exhibiting are so favorable that every American manufacturer ought to avail himself of the chance, if within hail of the Dominion. There will be no charge for power or for space, and goods will be admitted free in bond. There have been lots of loose talk lately about taking Canada into the Union, but it is evident that the question of commercial reciprocity has far more practicality about it. So long as we have friendly trade relations, the political issues are not worth bothering about; and the way to promote closer commercial intercourse is to show our Canadian neighbors at the St. John Exhibition that we have something it will be worth their while to buy. If they buy from us, we shall certainly buy more from them, and each party will be bettered by the exchange. The exhibition has our heartiest wishes for its fullest possible success.

NEW BOOKS.

ALTERNATING CURRENTS OF ELECTRICITY. By T. H. Blakesley, M. A. Second Edition, enlarged. London, 1889, Whittaker & Co. New York, D. Van Nostrand & Co. 129 pp., 5 by 7¼ in. Price, $1.50.

This excellent work, rearranged and enlarged, has now been included in the Specialists' Series, as a companion to a number of other works which have become standards for the student. There is sufficient new matter in it to make it worthy of some notice at this time. The author has taken up the subject of the action of alternating currents primarily and principally from the mathematical standpoint, discussing the phenomena which occur, and developing particularly the changes which are brought about by the insertion of condensers or other self-inductive devices in an alternating current circuit.

Among the new chapters we find a short one on the condenser transformer, which seems to be particularly timely in view of the fact that distribution by means of alternating currents in connection with condensers has been attempted by several inventors of late. The author discusses the various conditions under which such a system may be operated, and points out the interesting fact that when there is no self-induction in the remote section of the circuit, the current in that section will always be less than that in the section containing the generator, but if there exists self-induction in the remote section it may happen that the current in that section will be greater than the current in the section containing the generator. The author then treats of the conditions which must be observed in a combination of this kind for a maximum effect, and he gives some idea of the magnitudes which might be involved in such a system. Thus he supposes a case where the period is .01 of a second, the coefficient of self-induction .04, and the resistance of the circuit beyond the condenser 14.5 ohms; then a condenser of slightly under 48 micro-farads capacity would cause the current in the remote section to be double that in the generator section.

In treating further of the question of the transmission of power by alternating dynamic currents, the author discusses the various modes in which this may be accomplished, and investigates the manner in which machines may be run to the best advantage. On the question of the coupling together of alternating machines the author differs from Dr. Hopkinson for mathematical reasons as to the statement of the former that two such machines cannot work in the series, each doing work, and he proceeds to demonstrate mathematically that the thing is possible. While the author admits that one of the machines alone would, if driven by a sufficiently great power, give more power in circuit than the other two, he holds that that is a question distinct from the one whether or not two machines may run with stable motion in series, both doing work.

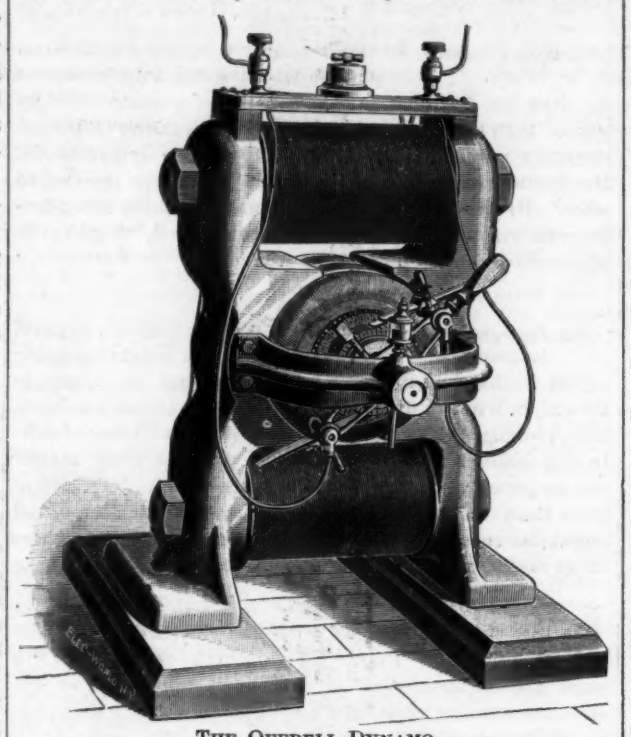
On the subject of magnetic lag, the author presents some arguments in proof of the fact that work is absorbed in the magnetization and demagnetization of iron, which phenomenon is met with in alternating current transformers. This has been doubted by various authorities, among them the Council of the Institution of Civil Engineers, who deny that a change in electro-kinetic momentum involves a generation of heat with a corresponding loss of energy in some other form.

As remarked before, the book is one which contains a considerable amount of information, notwithstanding the fact that the treatment is almost exclusively mathematical. It is uniform in size with the other of the same series, and is illustrated by diagrams wherever necessary.

THE A. B. C. OF ELECTRICITY. By W. H. Meadowcroft. New York: Frank F. Lovell & Co. 7¼ by 4⅝ in. Illus. 108 pp. Price, 50 cents.

With the rapid growth of the electric art, and the widespread introduction of electrical appliances, there has been engendered an intense desire on the part of the public to learn something about the mysterious force called electricity. There have been many attempts, and not a few of them meritorious, to meet this want, but there remains a vast educational work to be done in every direction. Among those who entertain the laudable ambition to become popular teachers in science is Mr. Meadowcroft, whose modest and entertaining book we have just been perusing with much pleasure. The learner who takes this book up will not find that it blunts the edge of his wit and willingness, but that its easy style of treatment will carry him through to the end without weariness. He will not be hurled from the rocks of repellent formulæ only to be buffeted back again by the crags of intricate diagrams, but can assimilate all the elementary electrical knowledge he needs with the least effort of digestion, and, to be even more mixed in our metaphors, is invited to go-as-he-pleases on a track of the softest tan bark.

In simple language Mr. Meadowcroft lays bare the secrets of electrical science and application, and shows that the principles are readily to be mastered, whether they relate to the telegraph and the telephone or the more modern dynamo and storage battery. The arrangement is systematic, the cuts are good, the typography and binding in cloth are excellent, and altogether the work is one that we can heartily commend.



THE OFFRELL DYNAMO.

The Offrell Arc Dynamo.

The dynamo, represented in the accompanying engraving, has been designed by Mr. Olof Offrell, electrical engineer, of Fort Wayne, Ind. As will be seen, it is of the consequent pole type, with magnets placed horizontally and forming a double horseshoe, the field coils being wound on the parts generally employed as the yokes. The field magnets are of the softest wrought iron and are turned down and tapped at the ends and fitted to the vertical cast iron pole pieces. The magnets and the pole pieces form a solid frame, being held together by nuts on the tapped ends of the magnets. The pole pieces are cast with a suitable base, to which wooden base boards are bolted. The field coils are wound on separate cores and slipped on to the magnets.

The armature, which is of the Gramme type, is supported by brackets of brass bolted to the pole pieces, and the shaft runs in phosphor bronze bearings fitted to the brackets. The armature core is made up of annealed wrought-iron wire, supported by a three-armed spider of brass. The armature wires from the different coils are carried direct to the commutator, to which they are connected by means of set screws.

The brush holders are adjustable, enabling the tension of the brushes to be adjusted without disturbing the setting of the same. This is effected by a set screw, provided with an insulated handle which clamps the brush holders to the brush pin. The brushes are set independently of this by an insulated thumb screw in the usual way. The brushes can thus be removed from contact with the commutator by manipulating this set screw, without disturbing the setting of them, and can be adjusted without risk of getting shocks.

The rocker arm is also provided with an insulated set screw, thereby enabling it to be set in any position.

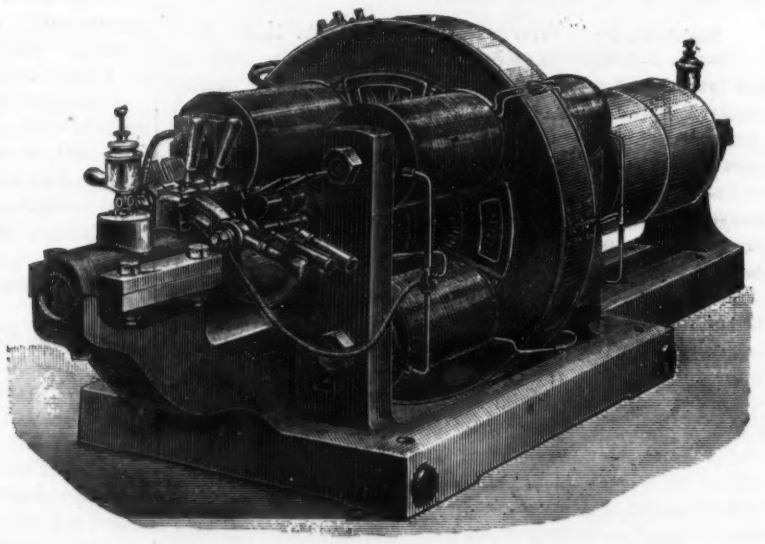
The cables from the brushes are carried to a board on top of the machine, on which are placed the terminals and also a switch for short circuiting the field coils, in case it is desired to "paralyze" the machine while running.

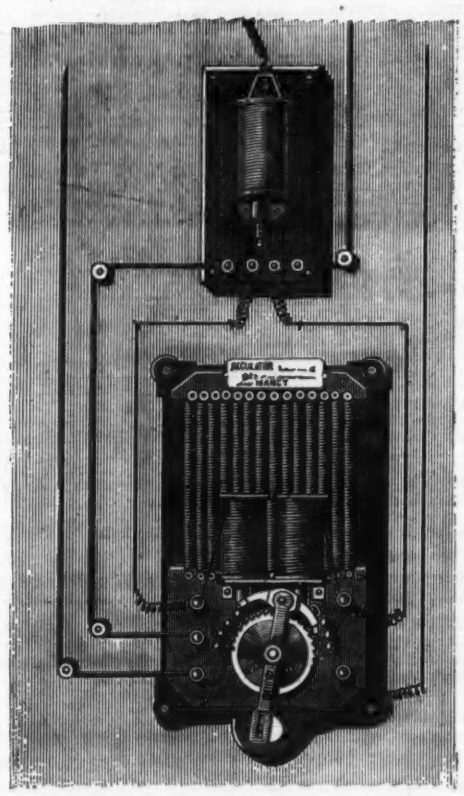
The dynamo shown in the illustration is a 12-light arc machine, wound for 10 ampères. The floor space required is remarkably small, being for a 12-light dynamo only 24 × 24 inches.

The object aimed at in designing this dynamo has been to obtain maximum output with minimum expenditure of material, and at the same time to reduce to a minimum the cost of manufacture.

The Henrion System of Electric Lighting at the Paris Exposition.

The Pilsen arc lamp is extensively employed in the lighting of the Paris Exhibition, about 160 being in use altogether up to the present. Of these about thirty are run by the Edison and 116 by the Marcel Deprez central stations, the remainder, which are installed in the Palais des Machines, and run off a Henrion dynamo fixed there,





FIGS. 1, 2 AND 3.—THE HENRION ARC SYSTEM AT THE PARIS EXPOSITION.

serving to light part of the nave and galleries of that building. The lamp, which is shown in Fig. 1, is in considerable use abroad, the merit of the principle of its regulation, by the direct action of solenoids without the interposition of clockwork or other mechanical devices, having long been recognized. The firm of Messrs. Fabius Henrion & Co., of Nancy, are the makers of these lamps in France, and have turned them out with first-class workmanship and the addition of some improvements in details of construction. The arc lamps, of whatever system, which are suspended in front of the restaurants fringing the exterior of the three main Exhibition buildings, and facing the gardens, are all enclosed bodily in large, opal egg-shaped globes, set in ornamental bronze frames of exactly the same design throughout. There is thus a general uniformity and symmetry in keeping with the facades of the buildings, and a pleasing coup d'oeil is produced.

In the Machinery Hall, in about a central position, this firm has an exhibit comprising a number of Henrion dynamos, automatic potential and current regulators, measuring instruments, switches and other electrical apparatus, which are well worthy of remark, and we note herewith, says *The Engineer*, some details of the various points of interest. The dynamos are constructed with two or four poles, and are all built with disc armatures of the Gramme type. Fig. 2 shows the four-pole machine with compound winding, the same type as that running the lighting in the Machinery Hall. In this machine the bed-plate, field magnet supports and bearings are cast in one piece.

The armature, which is wound on a soft iron wire core, is mounted on a copper disc, whose rim is turned hollow to receive the inside edge of the coil. The latter is then centralized and kept in position by copper arms bolted at one end to the disc. The connection between diametrically opposite coils, which in a four-pole machine are continuously at the same electric potential, is effected in the usual way by a series of brass rings insulated from each other, placed side by side along the shaft between the armature and commutator, each ring forming a top and bottom connection to a pair of opposite coils.

The length of shaft taken up by these rings is about the same as the length of the field magnets, as seen in the figure, so that the brushes are well clear of everything, and the commutator is easily got at all round. There are, of course, only two sets of brushes, 90 degrees apart, and turning together on a rocking frame. There are two brushes to each set, each of which can be independently adjusted as to pressure.

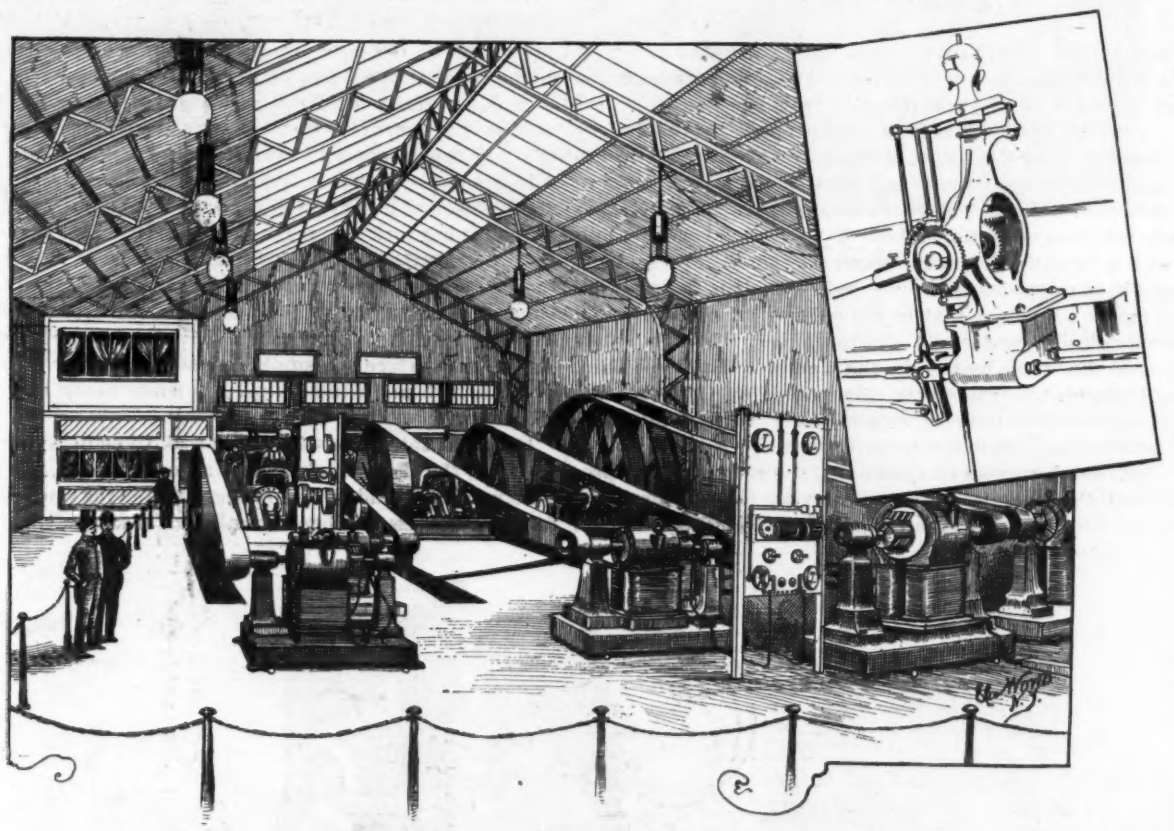
A dynamo machine, however well compounded, is only compounded at some fixed speed, and, therefore, as is frequently the case in the lighting of a factory, where a machine is run off the shop engine or shafting, some additional regulation is required to compensate for irregularities in speed. Such a regulator, which possesses points of great merit, has been devised by M. Henrion, and applied by him with success with several installations. This apparatus, which is exhibited in action, is shown in Fig. 3; its function is to add resistance automatically to the shunt field magnet winding in the event of an increase in speed of the machine, and vice versa.

Any alterations, therefore, in the difference of potential, supplied by the machine to the circuit of lamps consequent upon changes in speed, is, by this means, with resistance coils of suitable value, automatically compensated. In the first place an oscillatory motion is mechanically imparted to the lever carrying the double pawl, seen in the figure. This is effected by driving the small pulley seen at the lower end of the regulator by means of a band running from the dynamo shaft or counter shaft. This pulley carries a pin, fixed to it eccentrically, working in a slot at the lower end of the lever, to which it therefore imparts a to-and-fro motion. While often convenient, it is not necessary to drive the pulley of the regulator off the dynamo; it may be run by any separate means which happen to be most convenient, and not necessarily at a speed proportionate to that of the machine. The lever at its upper end forms the pivot to a double pawl which is free to move about its centre, and maintains ordinarily a balanced position.

On the same centre as the centre of oscillation of the lever, but not moving with it, are two ratchet wheels, rigidly fixed together, with their teeth in opposite directions, and attached rigidly to the ratchet wheels is a switch arm. The pole-pieces of the electro-magnets immediately above the lever are made to correspond in shape to the curve of the pawls, and the latter are made so that one rests immediately above each ratchet wheel. It will now be seen that should a current pass through one electro-magnet, say, that on the left-hand side, the left-hand pawl will be attracted upwards and force the other one to engage in the teeth of one ratchet wheel. As the oscillation of the lever still continues, it follows that the ratchet wheels are moved round by one tooth for each oscillation, and the switch arm is carried round with them.

The two terminals of the machine, whose potential is to be maintained constant under varying speeds, are connected directly to the fine wire solenoid at the top of the apparatus. When in action the iron core of this solenoid is held in a certain position in the coil by attraction, but should the potential of the machine increase, the core is drawn upwards and establishes a contact at the top with the left-hand solenoid. Now the core itself is coupled by means of a flexible connection to one pole of the machine, and the top and bottom contacts are connected respectively to the two outside ends of the two electro-magnets, the two inside ends of the latter being connected together and to the other pole of the machine.

It follows, therefore, that when the core is drawn upwards by an increase in potential, the left-hand electro-magnet is connected directly to the terminals of the machine, and causes at once the attraction of the pawl underneath it. This, by the oscillatory movement, causes the switch arm to move round over a series of resistance contacts, which inserts more resistance into the shunt circuit of the field magnets, and consequently reduces the potential again. For a fall in potential the core falls and makes the lower contact. This throws the right-hand electro-magnet into action, and, through the medium of the other pawl and ratchet, moves the switch the reverse way, by which resistance is cut out of the field. The resistance coils are included in the apparatus, of which Fig. 3 indicates the general appearance.



GRAMME ELECTRIC LIGHTING PLANT, PARIS EXPOSITION.

Diehl's Ceiling Fan and Motor.

As the hot weather approaches and intensifies, the demand for cooling drafts and breezes of air becomes greater. This year electric motor-fan outfits are more than ever popular and in vogue for "refrigerative" purposes. An ingenious adaptation of the electric motor to a ceiling fan is that recently made by Mr. Philipp Diehl, of Elizabeth, N. J., whose novel work in this and other branches will be recalled by our readers. The fan and motor attachment are shown in perspective in the engraving, Fig. 1, and Fig. 2 shows the motor attachment in section. As will be noted, the motor is almost identical with the Diehl motor placed in the fly-wheel of a sewing machine and illustrated in our issue of Sept. 3, 1887. The armature is carried by a flanged piece keyed to the shaft, and the magnets placed within the armature are supported by the sleeve through which the shaft runs. We may add that Mr. Diehl has had these fans in operation in his house for some time with excellent results. They are specially adapted to restaurants and other public places, as they require no belting or shafting of any kind, and run very quietly.

Electric Lighting Plant at the Paris Exposition.

[FROM OUR SPECIAL CORRESPONDENT.]

PARIS, France, June 4, 1889.—As everybody knows, Americans are "the most enterprising and progressive people on the face of the earth." This is granted. The electric light fraternity certainly do their share in upholding their country's reputation; hence electric light men in America will, doubtless, be interested in hearing of what their brethern across the water are doing in the field of light and power.

The main portion of the lighting at the Exposition is done from three large central stations, though there are

FIG. 1.—DIEHL MOTOR AND FAN.

a dozen independent companies doing lighting. It is my intention in this letter to give a description of one of these stations, the Gramme, dwelling particularly upon the steam plant, which is especially interesting, as it was installed by the principal engineering firm on this side of the great pond. High speed engines seem to be at a discount here, so that every energy has been devoted to bringing out a perfect low speed machine. In this competition, Davey, Paxman & Co., engineers of Colchester, England, seem to have won well-deserved laurels, as their engines have carried off gold medals and diplomas of honor at all the principal exhibitions of the last few years. They have also installed a 4,000 h. p. plant in the city of Paris to supply compressed air through the streets for the running of prime motors.

They have erected in the Exposition grounds, just to the north of the immense Machinery Hall, an iron and brick building with 6,800 square feet of floor space, specially designed for their plant. The boilers, nine in number, are at one end of this building, and are divided into two batteries. One, consisting of five boilers, supplies steam to the electric light plant, while the other four supply the engines of the British section in Machinery Hall. These boilers are of steel of the locomotive type, 100 h. p. each, and run under a pressure of 120 pounds. Each boiler has 780 square feet of heating surface, and is fitted with steam receivers for drying the steam. The boilers and piping are very neatly covered with an asbestos covering. No injectors are used, but the boilers are supplied with water by two Mumford double-acting pumps, one vertical and one horizontal. Before going to the boilers the feed water passes through two Schmid water meters, allowing of the exact measurement of the amount of water supplied, which is very useful in a day-to-day test. It is very noticeable, however, that no feed-water heater

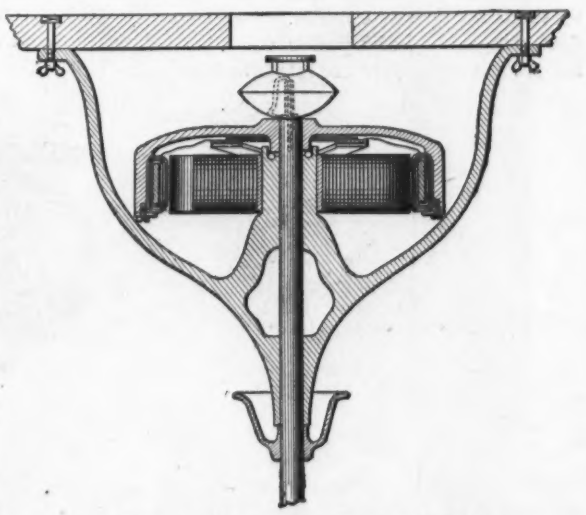


FIG. 2.—DIEHL MOTOR AND FAN.

is employed, cold water being pumped directly into the boilers.

The engines, four in number, are certainly fine running machines, doing excellent work and giving very little trouble. They are of the compound non-condensing type. The crank shafts are each wrought in one piece, and the cranks are set at right angles to one another. As connection can be made to the low pressure cylinder direct from the steam pipe at will, they are as easy to start up as a locomotive. What makes the engines particularly applicable to electric lighting is their fine regulation under varying loads. The governor is of the dead-weight type, but instead of the arms working on pivoted joints for lifting the weights, each arm is fitted with a friction roll. The arms are also bent at a certain angle, so that instead of the load being variable, it is constant. In other words,

the distance of the balls from the governor spindle is always the same, and the slightest variation is immediately felt.

As will be seen in the illustration, the Paxman valve gear consists of two slide valves, one main and one cut-off. The main valve maintains a contant lead, while the cut-off derives its motion from a link, the ends of which are connected to eccentrics which have different travels. One gives a late and the other a very early cut-off. The stroke of the link is controlled by the governor, thus determining the amount of steam admitted to the cylin ders. The cut-off valve lies on a ported plate lying upon the main valve, and loosely fitting the steam chest. The ports themselves are doubled, thus halving the travel of the cut-off slide, and increasing the sensitiveness of the governor. The largest of the four engines is of 500 indicated horse-power, four foot stroke, and makes sixty revolutions per minute. The distance between centres of cylinders is 12 feet. There are two driving pulleys 14 feet in diameter and 19 inches face, placed between the cylinders. This engine is of the "girder type," the girder forming the cover for the steam chest at one end and the pillow block for the crank shaft at the other, and it is in one casting weighing four tons.

The engine next in size is a 250 indicated horse-power machine of the Colchester compound receiver type. The cylinders, guide bars and pillow blocks are all bolted to a massive cast iron frame. It is supplied with two fly-wheels 10 feet in diameter and 16 inches face, running at 92 revolutions. The automatic valve gear on this engine is the same as has already been described, with the addition of a dash pot.

The next engine is of the same type as the last, and differs only in power, being a 140 horse-power machine, with 8-foot pulleys running 106 revolutions per minute. A small 10 h. p. engine is also included in the exhibit. It is very similar to the others, but at present is not driving anything. Each cylinder of these engines is supplied with indicating gear for taking cards.

The Gramme plant consists of six dynamos, in pairs, run by the three largest engines. The two run by No. 1 engine absorb 175 horse-power each, and supply current to forty-eight 60 ampère arc lamps in Machinery Hall. These lamps are connected three in series, and are in four large clusters of twelve each, making a fine illumination. At 9 P. M. these clusters are switched off, and the current is utilized in the illumination of the immense electric fountain in the gardens. Two Sundays ago a large globe around an arc light in one of these clusters fell, killing a twelve-year-old boy. The authorities have now built flower beds under the clusters, to keep people "away from under." The dynamos on No. 2 engine are used as a reserve, while the remaining two supply light to the British section of the industrial department.

The Gramme dynamo looks very much like an inverted Edison machine. Prof. Jamieson, of Glasgow, who is here for a few days, considers the pole pieces to be very badly designed, as so many of the lines of force are directed around instead of through the armature. In closing I may say that Davey, Paxman & Co. have two 140 h. p. compound condensing engines in Machinery Hall, running the entire shafting of the British section. E. W. H.

Bain Electric Coal Mining Machinery.

That electricity is a superior agent when used in connection with the transmission of power into coal mines is admitted on every hand, and the larger mine operators have been looking forward to the time when suitable electrical apparatus would be devised and so constructed as to withstand the rough usage to which mining machines are necessarily subjected in the various operations incident to coal mining. A mining machine must be compactly built, portable, easily moved by one man, and the mechanism covered as far as possible, in order to avoid injury from falling slate or coal; and it must be so simple in construction as not to be injured by the condensation of moisture or by water dripping from the walls.

The Legg coal mining machines, made by the Jeffrey Manufacturing Company, Columbus, O., and heretofore operated by compressed air, have always been built to withstand the rough service above referred to, but during the past two years the makers have been experimenting with a view of substituting electricity for compressed air, and have expended both time and money in endeavoring to secure a machine that would operate satisfactorily and economically under all circumstances. Finally, they placed the whole matter in the hands of Mr. Forée Bain, of Chicago, who visited the mines, and for a time became an actual miner in order to more fully study the conditions and the difficulties to be overcome.

Mr. Bain's success is shown by the cuts herewith presented, the machine illustrated having been in practical operation every day at the mines of the Shawnee and Iron Point Coal Company, Shawnee, Ohio, since the 1st of May.

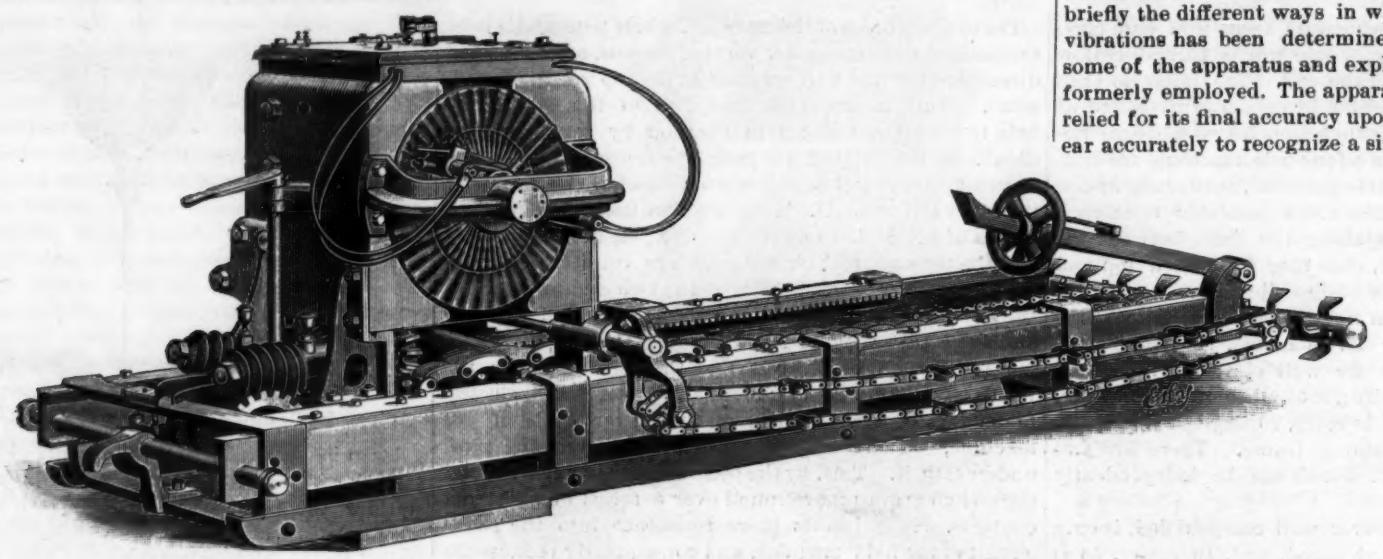


FIG. 1.—BAIN ELECTRIC COAL MINING MACHINE.

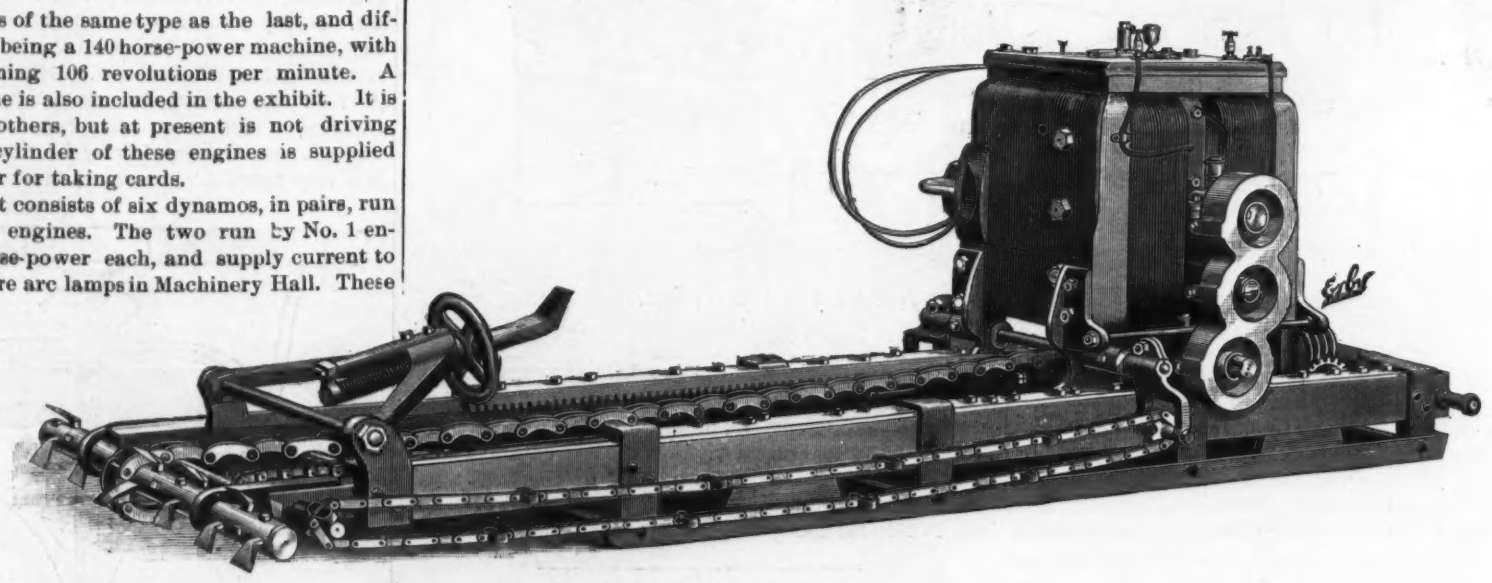


FIG. 2.—BAIN ELECTRIC COAL MINING MACHINE.

The motor occupies a space on the machine about twenty inches square, and requires a current of 60 ampères at 225 volts when working at the maximum speed and developing fifteen mechanical horse-power.

A cut five and one-half feet deep and three feet face is made by the machine in three and one-quarter minutes; again, these cuts can be made, the cutter bar withdrawn, and the machine moved ready for another cut in less than ten minutes, requiring no effort on the part of the attendant while the machine is at work. At this rate six cuts per hour, or sixty cuts per day of ten hours' work, can easily be made, amounting to 200 tons of coal undercut, which is the capacity of the machine referred to, though it is the opinion of competent judges that 300 tons of coal can be undercut if all conditions are favorable.

The Bain dynamo, furnishing the current to operate the mining machine, also supplies current to numerous incandescent lamps and to an electric hauling plant of eight horse power.

Mr. Bain is now constructing three additional mining machine motors, and a twenty horse-power locomotive for the Jeffrey Manufacturing Company to be used in these mines.

Prof. Spice on the Determination of Pitch.

The last of the present season's series of lectures before the New York Electric Club was given on Thursday, June 20, by Prof. Spice, of Brooklyn, the subject being, "The Determination of Pitch." The lecturer began by outlining briefly the different ways in which the rapidity of sound vibrations has been determined in the past, exhibiting some of the apparatus and explaining two of the methods formerly employed. The apparatus in all cases heretofore relied for its final accuracy upon the ability of the human ear accurately to recognize a similarity in pitch. As the ear cannot be depended upon for a minute and a quarter, during which time it has to judge of the identity of two sounds, to furnish a reliable verdict, it obviously becomes necessary in more refined calculations to employ a method in which the necessity for its testimony shall be eliminated.

In the method shown by Prof. Spice no knowledge or appreciation of actual pitch is necessary, as the vibrations of the tuning fork are registered and tell their own tale. Briefly described, the apparatus consists of a vertical tuning fork properly secured in a framework, the prongs being uppermost; a wire attachment is secured to the end of one of these prongs in a position to mark a wavy line on the surface of a smoked glass slide, which is drawn over the fork in a direction perpendicular to the line of its vibration.

It is clear that were the tuning fork to be in a state of rest, and the slide simply drawn across its ends, the little wire marker would trace a straight line in the smoked surface of the glass. When vibration is set up in the fork, the latitudinal motion of the marker and the longitudinal motion of the sliding glass combine to make a wavy line, in which the number of waves registered represents the number of actual vibrations of the fork.

In order to introduce the factor of time into this register of vibration, a second's pendulum controls the action of an electro-magnet, the armature of which is provided also with a little wire marker which cuts a straight line on the smoked glass. At the end of each second the circuit is closed and the marker pulled away from the glass, making a break in the time line. By drawing lines at these breaks perpendicular to the time line, and also intersecting the general direction of the wave line at right angles, it is a simple matter to count the whole number of vibrations to the second. The fractional part of the last vibration can be determined microscopically with great nicety. A microscope is provided with a horizontal wire, which in use must, of course, be perpendicular to the lines under examination. The motion of this wire is controlled by a

thumb screw graduated in degrees. Knowing the number of turns necessary to move the wire from the crest of one wave to that of the next, the fractional vibrations can be accurately interpolated.

Prof. Spice closed his lecture with an interesting description of the practical use of his apparatus in the determination of pitch to a nicety for musical purposes. It is found that the verdict of musicians into whose court these achievements must at last come for final judgment is always corroborative.

Nearly every step in the lecture was illustrated by appropriate experiments, and the markings on the glass register were thrown upon a screen. Although the main features of the method are similar to those used in the rotary chronograph used in astronomical observations, yet the absolutely accurate marking of the time line by means of electricity shows how closely allied are the results from its use with the demonstrable proofs of pure mathematics.

At the close of the lecture, Prof. Spice was tendered a vote of thanks by the club.

The Sprague Electric Road at Atlantic City, N. J.

We illustrate on this page the fine Sprague road at Atlantic City, which has been in operation for about six weeks, during which time the cars have made 6,464 trips, without the loss of a single trip, although there have been no reserve cars to supplement those in use.

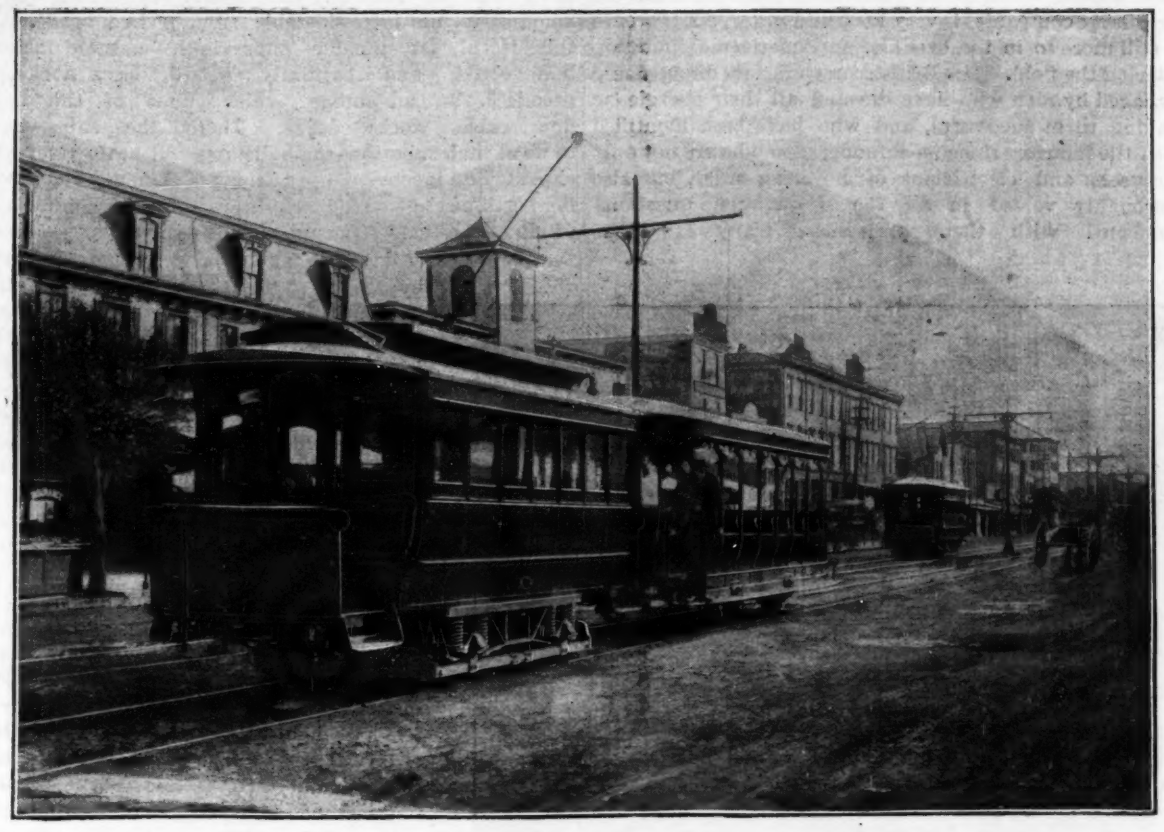
The original order of the Pennsylvania Company, which controls the system of street railways at Atlantic City, was for six cars, each to be equipped with two 15 h. p. Sprague motors, and each to be capable for drawing an ordinary street car. Since the demonstration at Atlantic City, this order has been increased to sixteen electric cars, each capable of drawing an additional car.

One noticeable characteristic of this road, is the extremely light and ornamental character of the overhead system. The poles are of iron throughout the entire length of the line, and are placed between the two tracks, using the double bracket method of support for the trolley-wire. These poles were put up by the Pennsylvania Railroad Company, themselves, and show how unobjectionable a system using overhead wires may be, when sufficient regard is paid to this portion of the work.

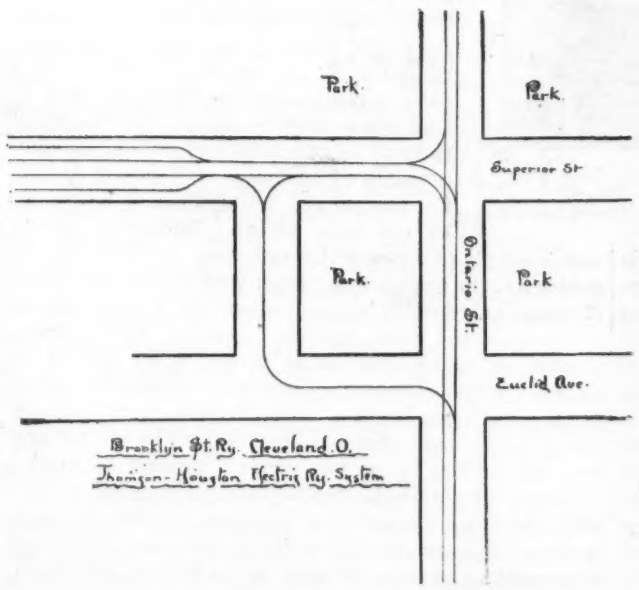
The Thomson-Houston Road at Cleveland, O.

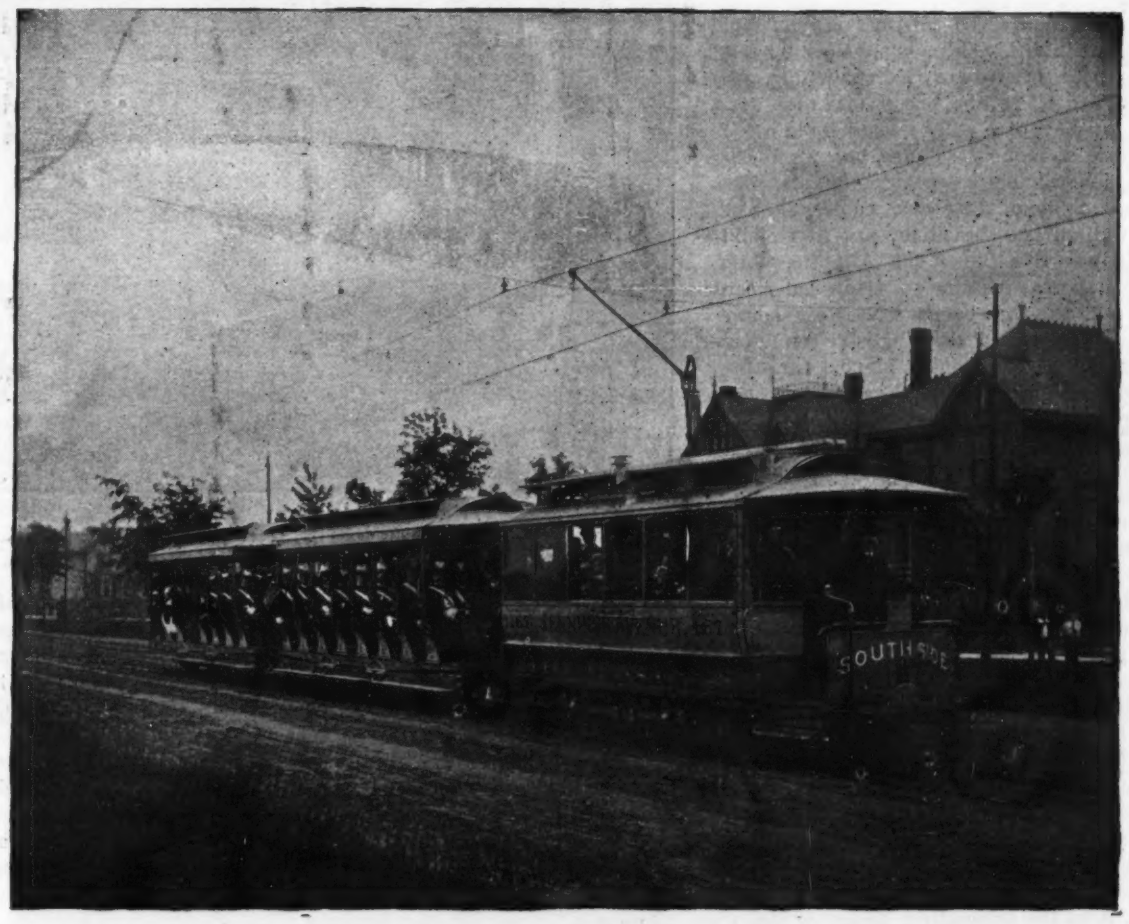
We illustrate on this page the new Thomson-Houston road built for the Brooklyn street railway of Cleveland, O. This is a road which has no fewer than 23 curves of short radius while the grades are all heavy. Another noteworthy feature is the fact that it was begun and put in operation in one month. On April 16th the work was commenced, and on May 1st there had been completed 1¼ miles of double track, the engines and boilers set, the generators put in position, and the cars in practical operation. On May 19th the line was opened the entire length, with ten motor cars, each towing two open cars for 1¼ miles, and on the remainder of the track towing one car. The total length of the road is 4¼ miles of double track, and extends from Brooklyn to the Public Square, through the business portion of the city. No expense has been spared in the construction of this road, and the track is said to be the finest laid in the country, the Johnson girder rail being used.

The road crosses the Central Viaduct over the Cuyahoga River, which is 2,840 feet long and 102 feet high, and has a 287 foot draw.



THE SPRAGUE ELECTRIC ROAD AT ATLANTIC CITY, N. J.





FIGS. 1 AND 2.—THE THOMSON-HOUSTON ELECTRIC ROAD, CLEVELAND, O.

In constructing this line wooden poles were used for three miles and iron poles for 1¼ miles, those on the viaduct being among the best which have been used as yet in electric railway work.

The cars, which were built by the John Stephenson Company, are 20 in number, 10 each equipped with two 15 h. p. Thomson-Houston motors and 10 tow cars, painted and finished in the best possible manner.

To each motor car is attached the T. L. Johnson patented brake, which enables the motor man to control a three-car train with perfect ease and quickness, and without any disagreeable jar or jerk. The brake consists of a shaft that is constantly kept in motion by a sprocket chain from one of the axles of the car. On this shaft there is a tight disc and a loose drum, and to the latter is attached a chain. The operating device on the platform consists of a lever by which the tight disc is brought into contact with the loose drum, forcing it to rotate and thus winding up the chain, which applies the brake to either one or two cars as desired.

The car and inspection house is provided with pits, so that the cars can be cleaned and inspected without causing the loss of a trip. The power house is situated near the track and is equipped with two 150 h. p. boilers, built by the Variety Iron Works, Cleveland, and two 125 h. p. Ball engines. The electrical plant consists of two 80 h. p. Thomson-Houston railway generators and switch-board with necessary appliances. For eight days, working with 10 motor cars, and each towing one, and sometimes two, cars, carrying on an average 10,000 passengers daily, working one boiler, two engines and both generators part of the time, the coal consumption has been 500 pounds of slack coal per hour, at a cost of $1.20 per ton. This line is giving perfect satisfaction to the public, and the railroad people intend to equip the entire line with this system as soon as possible, which of course means that they are perfectly satisfied with what has already been done. Fig. 2 is a view on the line, and Fig. 1 is a diagram of a portion of the track.

Dragging Motors Through the Mud.

To the Editor of The Electrical World:

SIR: Permit me once more to occupy a little of your space to reply to Mr. J. H. Bickford, of the Sprague Company at St. Joseph, Mo.

In your issue of June 15, he says that I do not know the conditions to which a street car motor is subjected, and that his company place their motors within 10 inches of the ground, etc.

Of course I don't know it. Because the whole world sins, is that any excuse for us to do likewise?

Because the Sprague Company prefer to place their motors within 10 inches of the ground without any protection, does that excuse us for doing the same? The truth is, this is no place for the motor.

It would be much more sensible for them to produce a *fire-proof armature* that they will guarantee not to turn out, and box it in so as to protect it from the wet. Instead of this, they have bent all their energies to build a waterproof armature for the sake of being able to drag it through the mud.

H. F. WATTS.

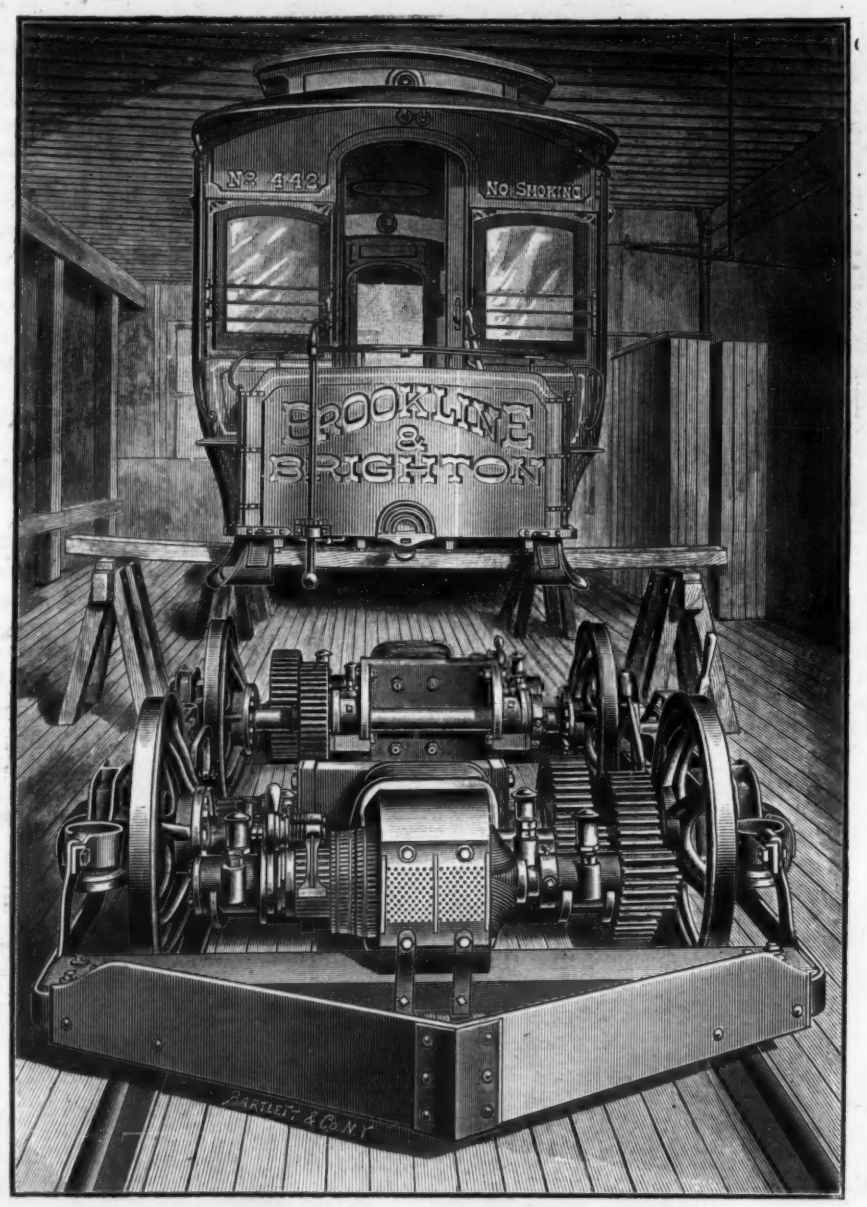
ALTOONA, Pa.

Bentley-Knight Double Motor Truck.

In a recent issue we referred to the work being done by the Bentley-Knight motors in Boston, and stated that their number is being constantly increased. We illustrate on this page one of these double motor trucks supplied to the West End Street Railway Company, of Boston, by the Bentley-Knight Electric Railway Company, eight of which trucks are now in use upon the Chestnut Hill, Boylston and Beacon street route of that railway. The cars equipped with these trucks have been in operation for the past five months, making a regular speed of 12 miles an hour, and having attained a maximum speed in regular service of 19 miles per hour. On Sundays and holidays each of these cars tows two others, and the speed is not sensibly diminished. Each car is equipped for use with under-contact, overhead conductors. For summer use the West End road is now putting on a number of open cars, each equipped with single 20 h. p. Bentley-Knight machines, and for excursion work and heavy service it has just received from the same company a 40 h. p. machine, which it is expected will be upon the road within the coming week.

In a recent test undertaken on this road, 12,000 passengers were moved in one day, with a consumption of five tons of coal and an average cost for fuel of 1¼ cents per car mile.

The engraving shows the car body lifted from the truck, leaving the latter free for examination.



BENTLEY-KNIGHT DOUBLE MOTOR TRUCK.

A Boom in Submarine Cables.

BY HERBERT LAWS WEBB.

Attentive readers of THE ELECTRICAL WORLD will acknowledge that the title of this article is not ill-chosen. The columns of last week's issue positively bristle with news of new cable schemes, Brazilian, Canadian, Chilian, German and Pacific. The directors of the cable construction companies in England must be rubbing their hands with glee and gloating to their hearts' content over the magnificent prospects which are opening up before them of a phenomenal rush of work, such as the history of submarine cable-laying has never seen.

No less than seven projects are on foot for the establishing of new submarine lines, and if all these are carried out within the next year or so, the ocean telegraph system of the world will be augmented by—I hesitate to name the figure, but placing it at a moderate mark—some 15,000 nautical miles. Some of these new cables, such as the Chilian and Brazilian, are to be laid entirely on this side of the Atlantic, while others, such as the direct German-American line and the vast Pacific system—a *bonne bouche*, at which the English contractors have been casting hungry glances for some years—will have their landing places on the shores of this great continent, so that America may be said to be directly interested in all of them.

Doubtlessly American capital will play no inconsiderable part in carrying out these enterprises, but the pertinent question to ask is this: Will American electrical and engineering industry preserve the attitude of inertia which it has maintained with regard to this subject during the past forty years, in which period no less than 120,000 miles of submarine cables have been submerged in all parts of the world, and will the country which boasts of being the first in the universe in the field of electrical engineering let pass the present opportunity of founding a new industry and making a name in one of the finest branches of our great and all-pervading science?

As I have stated above, since the year 1850, when the first practicable cable was laid across the English Channel, the submarine telegraph system of the world has grown to the astounding figure of (let there be no mistake), one hundred and twenty thousand miles. Of this enormous length not a yard has been constructed in the United States, and the only ocean cable factory at present existing outside of Great Britain, is a comparatively small concern at Milan, which nevertheless has done some good work for the Italian and Spanish governments.

As will readily be seen the average yearly output of submarine cable has been about three thousand miles. Of course some years have been exceptionally busy ones and others unduly slack. I have no statistics by me to refer to, but I will venture to assert that in no single year during the history of submarine telegraphy, have so many important contracts and concessions been offering as there are at the present day.

With regard to cable construction in the United States, some say that it is impossible to compete with the British manufacturers. To these I reply that no one has ever tried, and no man knows what he can do until he tries. Others vaguely state that "it is bound to come some day." These easy-going prophets will perhaps agree with me that the time has arrived for action in the matter. If the present outlook does not justify an attempt being made, surely the future American cable constructors must be waiting for a contract to lay a cable from the earth to the moon, which it is needless to say they will never get.

No doubt, apart from the obstacles referred to in my former article, there are other formidable difficulties, or rather deterring influences, which must be taken into account on this side. England has held the monopoly of cable making for 40 years. The competition between the three large companies is very keen and bitter, but it would be still more so in the event of an American corporation entering the field. The British companies are directed and managed by men who have devoted all their energies to making them successful, and who have been identified with the industry since its infancy, men who are not only engineers and electricians of no mean order, but also thoroughly versed in all the commercial questions connected with their profession, many of them good linguists, by necessity great travelers, and last but not least, accomplished men of the world accustomed to carrying out delicate negotiations involving interests of considerable magnitude. Nor must we forget the large technical staff of engineers and electricians on the rolls of the cable companies, a body of scientists who form no small proportion of the electrical engineering profession in Great Britain. Amongst them there are many clever and energetic men who have had a vast amount of experience in cable engineering in all parts of the world, and to them much credit is due for the present state of perfection to which the great industry of cable construction and laying has been brought.

The cable fleet of the world numbers some thirty-six vessels, with an aggregate gross tonnage of 53,802. Of these all save five fly the Union Jack. The English construction companies own nine ships, with an aggregate gross tonnage of 26,923, or a trifle over half that of the entire fleet. Messrs. Pirelli & Co., of Milan, own one steamer of 1,220 gross tonnage. The remainder of this great squadron, which renders a service to humanity only second to that of supplying food, consists of repairing ships in the employ of the different governments and telegraph companies throughout the world.

It is obvious that the splendid organization of which I have endeavored to give a mere outline in the preceding paragraphs places the cable manufacturers in a very advantageous position as regards any future competitors that may spring up, and that position they will naturally spare no possible effort to maintain. But difficulties were made to be overcome, and no good American will be disposed to admit that that which one branch of the great Anglo-Saxon race has done, and is doing, the other branch cannot do also, and do as well.

In conclusion, I may point out one or two advantages which an American cable factory would possess over the English ones. The expenses of a cable ship, of say 2,000 tons, with all hands on board, sum up to about $500 per day; where work is to be done on this side a considerable curtailment of expense would be due to a shortening of the voyage out to the scene of operations, and home after the conclusion of the work. In some cases, especially as cable ships are generally slow goers, the saving would amount to no inconsiderable sum. Then again, and this is of far greater importance, a cable factory here could, and naturally would, have dock-side premises, an advantage which none of the London cable works enjoy. There the ships have to lie at their moorings some distance out in the river; the expense and inconvenience of this are obvious. The mooring berth has to be constantly cleared of the accumulation of mud deposited by the tide, and this involves no small outlay; the cable has to be led on board by means of guides placed on floats, and the operation is of necessity slower and involves more power and labor than if the ship's tanks and those in the factory were only separated by a distance of a few yards; lastly, all the ship's stores, buoys, machinery, etc., have to be put on board by means of lighters. Thus, it will be seen that a cable factory with dock-side premises will possess one very great advantage over those located on the banks of a comparatively shallow river.

I have endeavored, in a modest way, to point out a few of the *pros* and *cons* that more readily suggest themselves with regard to the subject of submarine cable making on this side of the Atlantic, but I feel confident that if the attention of the electrical profession is once aroused, American ingenuity and enterprise will speedily find methods to increase and multiply the *pros*, and cause the *cons* to diminish and finally reach the vanishing point.

Lightning Rod Practice in Germany.

The following abstract from a repo by a German lightning rod inspector w be of interest at the present time. Herr F. Niesen, whose paper appears in the *Elektrotechnische Zeitschrift*, No. 689, says that for the last seven years he has had charge of the rods on the Berlin Inland Revenue buildings. At the beginning of that time he found them in a very unsatisfactory condition, and had many of them repaired. Since then all the conductors have in general lasted well—both copper rope and also iron rod and rope, the principal cause of injury arising from the presence of workmen on the roofs. Speaking of the value of resistance tests to discover faults, he considers them of great value, as he has several times detected by that means cases where the wire was eaten through by corrosion, and yet did not show it visibly without the very closest inspection; he has also detected sundry bad joints by the same means. The earth test he uses is simply to measure the resistance between the conductor and the nearest water-pipe; with an ordinary bridge of course polarization is an objection, but is not sufficient to prevent the test showing whether the resistance is over or under two ohms, which is all that is required. Where there are several earth plates there should be means of disconnecting each of them from the conductor for testing, otherwise they may all be bad but one, and yet test as below two ohms. Several interesting strokes are mentioned. In one case, in Holland, a water mill was struck (no rod); the lightning, coming down the front of the house, broke through to the top of a looking-glass inside, and then out again at the bottom, only injuring the silvering at the point it entered and left, and at the line between the top and bottom half of the glass, which was made in two pieces. Another, and at the present time more interesting case, is that of a house with a rod; which was struck some years ago; the house was not damaged, but a workman standing near the rod was stunned.

Three Years in the Penitentiary is the sentence inflicted on W. B. Derby, in Boston, for embezzlement as cashier of the Mutual District Messenger Company.

Train Telegraphy.—A telegram from Raleigh, N. C., of June 18 says: A test was made to-day on the Raleigh & Gaston Railroad in the presence of a number of prominent railroad men of a process recently invented by Baylus Cade, of this county, for telegraphing to and from moving trains. The current is maintained by means of a drag which is attached to the car, and which slides over a set of wires laid along the track. Messages were received from the offices at Raleigh and Greensborough while the train was running at the rate of thirty miles an hour.

A New Carbon Battery.

Probably the three most important points in a primary battery are low internal resistence, high electromotive force and long life. The Knapp Electrical Works, of Chicago, have recently placed on the market a cell combining, they believe, all these requisites, and they have aptly termed it the Chicago carbon battery. They claim that it is the most perfect one made for open circuit work. In addition to the above enumerated points the manufacturers claim that this cell has many other features that add to its value. As will be seen by the cuts shown on this page, the carbon surface presented to the action of

FIGS. 1 AND 2.—THE "CHICAGO" CARBON BATTERY.

the fluid is unusually large, the oval-shaped carbon element being $3 \times 4 \times 5\frac{1}{2}$ inches in size. The binding post is so attached that no corrosion can take place, nor can the zinc be affected in that manner, the manufacturers claim, as the zinc rod is held in position by an insulating plug fitted so tightly in the cover that neither air nor water can pass through.

The cell proper consists of three parts; the glass jar, the carbon, and the zinc and plug. When set up ready for service the cover fits so perfectly that the jar is practically sealed, and no perceptible evaporation takes place. Thus the cell will probably require no attention for from two to three years, depending on the amount of work performed.

The sal ammoniac sent out with these cells is of an unusually high grade, the proper amount being carefully packed in small boxes.

A New Magneto Fire-Alarm System.

The operation of fire-alarms on the magneto principle in order to obviate the time, labor and expense incident to the use of batteries has long been striven for. After considerable experimenting, the problem has been successfully solved in a simple system just devised by the Viaduct Manufacturing Company, of Baltimore, Md.

The system is specially adapted for use in towns of from 1,000 to 20,000 inhabitants, and in factories, school-houses, or other large buildings where it is desirable to establish quick and direct communication with a fire-alarm department, engine-house, etc. The expense of maintenance is little or nothing, as no battery is required to be kept in order, except a small open circuit one to operate an alarm gong.

By reference to the engraving, Fig. 1, it will be seen that the apparatus for the engine house consists of a magneto signal bell, an annunciator drop, a vibrating bell, and a battery box to contain two cells of battery. When an alarm is sent in from the street box, shown in Fig. 2, it causes the annunciator drop to fall into a specially-devised circuit closer, which closes a local wire on the vibrating bell, causing it to give a continuous alarm until the drop is replaced in its normal position by the attendant. He is then required to answer the alarm by signaling back on the magneto bell. This operates the magneto extension bell in the street box, which signifies that the alarm has been received.

The alarm boxes can be placed upon poles and on the side of buildings, or in any other convenient position on the streets. As many boxes as may be desired can be placed on one circuit, provided it runs in a particular direction from the engine house.

In addition to the magneto extension bell, the street box contains an improved lightning arrester to protect the instruments, and a magneto generator. The simple act of opening the door automatically actuates the generator, thus sending the alarm to the engine house. A very slight movement of the door is sufficient for the purpose; consequently no experience is required to operate it. When it is not desired to have any one in constant attendance at the engine house, a tower bell can be arranged to give a general alarm automatically. Simplicity, efficiency and cheapness have been the principal aims kept in view in devising the system, which seems well calculated for the fire protection of moderate-sized areas.

Improvements in the Gramophone.

Notwithstanding the simplicity to which the gramophone of Mr. Emile Berliner, of Washington, has been brought,* the inventor has recently made an important advance in a change which he has adopted for his etched sound records. Hitherto Mr. Berliner thought it necessary to use pure zinc discs, which are expensive, and, being very soft, had to be made thick to prevent bending. He now finds that common hard sheet zinc, such as stove dealers use, is far superior, etches quicker, permits the recording stylus to slide easier in tracing the sound vibrations, reduces the friction noise in reproducing and, being harder, remains practically unaltered after many reproductions.

As a consequence, articulation is remarkably clear and the cost of discs is reduced to a few cents. Common zinc can be flattened accurately on a level surface by simple pressure over night, and with his new machine Mr. Berliner is enabled to put on an 8 inch disc a 5 minute conversation, which is not at all the limit attainable.

A simple calculation shows that even under these *preliminary* conditions a box eight inches square and one inch high may contain reproductions lasting four hours continuously, or 30,000 words of ordinary conversation, which capacity may be doubled by using both sides of the discs. With the loudness of ordinary conversation the time of etching with chromic acid is four minutes, and with electricity and sal-ammoniac, one-half minute.

The above calculation is made on the basis of records in which the outer circle revolves at the same rate as the inner circle. If a machine be used in which provision is made for equalization of linear velocity the same box would contain conversation lasting 24 hours, using both sides of the discs.

FIGS. 1 AND 2.—A MAGNETO FIRE ALARM SYSTEM.

* See THE ELECTRICAL WORLD, Aug. 18, 1888.

The Ganz Dynamo Anticipated.

To the Editor of The Electrical World:

SIR: I do not know whether I can lay claim to being the first inventor or not of the type of dynamo which is described in your issue of May 25, made by Ganz & Co., but I have drawings for a dynamo, armature and field, built up of alternated plates like theirs, only my field and armature were both of U or V-section. My machine was put together in a different way, and, as I think, a better one. I made part of the drawings over two years ago, and should have had the machine patented had it not been for lack of money and the doubts on the part of those to whom I applied for aid as to my understanding of the subject. ARTHUR H. BURNETT.

WORCESTER, Mass.

E. M. F. of the Gravity Cell.

To the Editor of The Electrical World:

SIR: Will you please answer the following questions: I have a small electric motor which takes about three volts to run it. How many crow-foot gravity batteries would it take to run the same motor? I can run it on one cell of 8-inch Grenet. Or, in other words, what is the E. M. F. of a gravity cell? By answering this question you will greatly oblige a young subscriber. F. W.

NEW YORK CITY.

ANSWER.—The E. M. F. of the gravity cell is 1.07 volt. Three gravity cells in series would therefore give the required E. M. F. of three volts. On account of the high internal resistance of these cells, however, you might find it necessary to employ six of them, coupled three in series, two in parallel.—EDS. E. W.

Copper and Bronze Commutators.

To the Editor of The Electrical World:

SIR: Will you please inform me as to the relative conducting values of copper and gun metal (9 copper, 1 tin). Will not gun metal give better results than copper for commutator bars as regards wear? Can there be any objections to their use as conductors when area is ample for current? Would not the friction between brush and bars be enough less with brass bars to offset the heating effect due to the increased resistance of the brass when same cross section and length of bars are used with same current in each case?

If you will please inform me regarding the above I will greatly appreciate it. J. C. MCC.

JACKSON, Mich.

ANSWER.—As regards resistance, there is practically no difference between the two metals when used as commutator brushes, which are usually made of ample section. Brass and gun metal make excellent commutator bars and wear better than copper; being harder, the wear takes place to a large extent on the brushes, thus preserving the commutator. Smoothness of wear might probably reduce the friction, as remarked, but the resistance is so small in either case that the heating effect due to it is inappreciable. Probably the reason why brass commutators are not more generally in use is on account of their increased cost, though we have recently seen them introduced in electric car motor work to good advantage. There is no objection to the use of brass or bronze in conductors, if of sufficient size, except that of cost.—EDS. E. W.

A New Testing Generator.

The electrical test generator shown on this page has lately been placed on the market by the Electrical Supply Company, of Chicago. It is designed to supersede the use of the magneto in testing electric light circuits, dynamos, etc., and whenever a perfect device of high efficiency is desired.

Being of small size, strongly and compactly built and handsome in finish, it can easily be carried about and used

A NEW TESTING GENERATOR.

either in tracing up dust contacts on commutators or for leaks in the main line.

Telephone Tickets.

The New Haven *Register* has the following: Beginning with the first day of June the Southern New England Telephone Company issued tickets for the use of those who are not subscribers to the exchanges of the company. The company has found that there are a good many people to whom the occasional use of the telephone is a great convenience, for which they are willing to pay a small fee. Now the only way that they can avail themselves of the convenience of the service is to ask the use of their neighbor's instrument, thus bothering the neighbor and taking from the company that for which they do not pay. These tickets allow the holder one local communication from any subscriber's station, where the subscriber is willing to let the instrument be used. The tickets will cost 10 cents each, in strips of five, and when the holder of a ticket uses an instrument he will leave a ticket with the subscriber whose instrument he uses. This ticket the company will redeem as five cents cash in settlement of its bills with the subscriber. Thus the company receives a small fee for the service that it renders, and the subscriber receives a small compensation for the accommodation that his instrument has been to the user of the ticket. The company is also testing several devices on the plan of "put in your nickel and take out a bun," for the automatic combination of payment and access to the telephone.

The "Jolin" Pocket Galvanometer.

The accompanying engraving illustrates a handy and compact galvanometer, which can be applied in a great many ways in testing work. The coil of the instrument has two wires wound on it, one fine and the other coarse.

THE "JOLIN" POCKET GALVANOMETER.

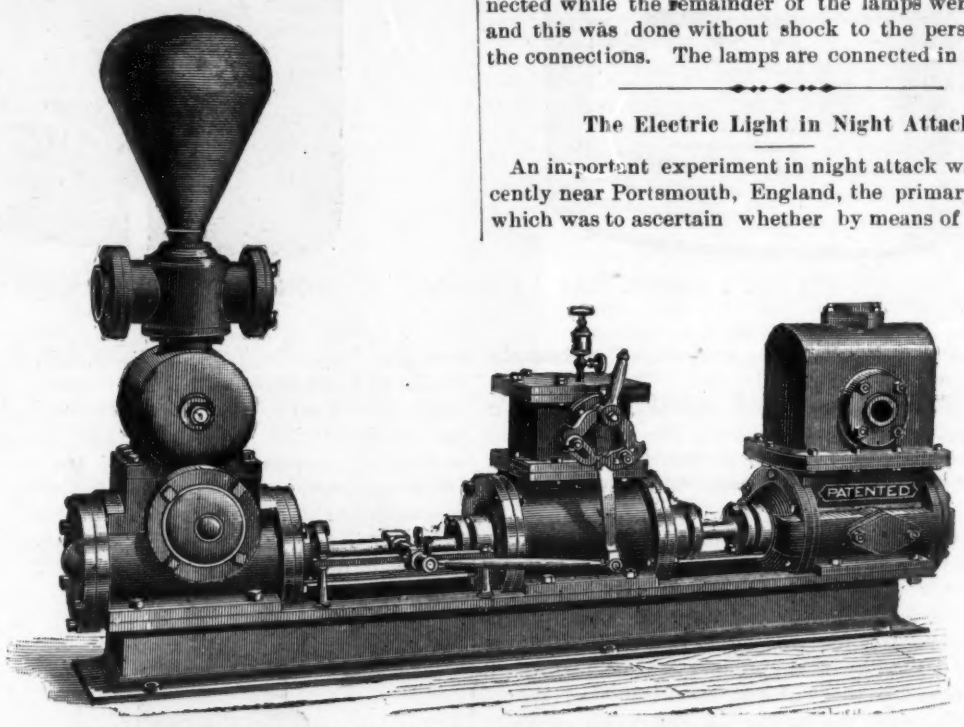
The fine wire is wound on the bobbins first, and connected, one end to the case and the other to the right-hand terminal. The thick wire is connected from the case to the left-hand terminal. The wires are so arranged that if the wire from the copper pole of the battery is connected to the case, and the wire from zinc is connected to one of the terminals, the needle at once points to that terminal, thus telling the direction of current. The two circuits are so arranged that if the battery wires are connected to the terminals the current acts in the same direction and increases the deflection. The fine wire is 200.6 ohms, and the thick wire .65 ohms; total, 201.25 ohms. The ordinary pattern, as used by the telephone companies, is wound to 20 ohms; the instrument is 1¾ inch diameter and ¼ inch thick—the size of a Waterbury watch—and is so constructed that on taking out two screws the complete works can be removed for replacing a broken glass without disturbing any part, and all the working parts can be examined without taking to pieces. It can, of course, be wound to any specification, and will do for all the work for which an ordinary lineman's detector is used, but with the great advantage of being readily portable; it can be carried on the watch chain as a watch.

This neat little device is made by the Woodhouse & Rawson Electric Supply Company, Limited, London, Eng.

The Niagara Direct Acting Steam Pump.

Reliability of service is one of the principal objects to be kept in view in the operation of central electric supply stations, and in order that this may be attained trustworthiness in all the working apparatus of the station is necessary. One of the most important of these adjuncts is the pump that feeds the boiler, and we illustrate on this page the Niagara direct-acting steam pump designed with a special view to continuous service. As will be seen the pump is cast in separate parts, so that in case of accident or breakage, only the immediate parts affected need be replaced, as its cylinders are separate from bed-plate, water valve-chest, discharge and air-chamber.

The arrangement of water-valves is such that in case of obstructions entering the valve chamber through the suction pipe, the valves may be taken out, cleaned and replaced in the shortest possible space of time, for which half a minute has been found, on occasion, sufficient.



THE "NIAGARA" PUMP FOR ELECTRIC LIGHT STATIONS.

The accessibility of the valves is apparent by a glance at the bonnet of the valve-chest.

To extract the water-valves, it is only necessary to remove one nut, no further fastening being requisite, as the valves are four square pieces of metal, kept in place by the bonnet shown. The valves on each face present an accurately fitting surface to the valve-seat in the chest, so that each of the four surfaces may be successively used. The valves are made of composition metal, and both the steam and water cylinders are fitted with metallic ring packing. The construction of the steam valve insures its starting whenever steam is let on, no matter at what point of the stroke the piston may be; hence, it is impossible to be set on the centre, and moreover, it can be run at any rate of speed. Thus, when feeding the boiler, it can be made to run as fast or as slow as may be desired. Thus by a steady and certain supply of water to the boiler, economy and safety are both secured.

Improvements in the Wimshurst Machine.

With a view of adapting it to medical purposes, M. Oudin has introduced several modifications in the Wimshurst machine, which has frequently been noticed in our columns. The two large glass plates are replaced by ebonite discs fifty centimetres in diameter. These discs are provided with wooden projections covered with tinfoil, so that the brushes do not touch the plates themselves. Brushes, combs and plates are mounted so that they can be easily altered as required. It is possible, for instance, to do away with two plates and transform the whole arrangement into an ordinary two-plate machine. The condenser employed by M. Oudin is of a somewhat peculiar character. It consists of glass plates 24 by 18 centimetres, on to one side of which is fastened a narrow strip of varnished tin 3 centimetres broad; these strips start from the smaller sides of the plates, and are about 17 centimetres long. The plates are arranged one on the top of the other to any required number, the ends from which the metal strips start being laid alternately left and right, and the strips themselves being connected to two metal pillars in connection with the machine. The combs employed by M. Oudin have toothed edges in lieu of the usual long projecting points.

A Quickly Constructed Electric Light Plant.

BY W. H. MARKLAND.

We hear often of quick work in erecting an electric light plant, but I think faster time was made at South Fork, Pa., than ever before.

The floods of May 31 that did so much damage at Johnstown washed away a bridge at South Fork on the line of the Pennsylvania Railroad. The Pennsylvania Railroad electric light car, which is equipped with a complete electric light plant, arrived at the bridge at 7 P. M., June 1. With the help of five men, four 18-foot poles were erected and an arc lamp hung on each. An arc lamp was also placed on one end of the car, making five arc lamps in all. All wires were run and the connections carefully made, so that polarity was right in all cases. The lights were started burning at 7:35 P. M. and burned without interruption until midnight. One of the lights was placed about 700 feet from the car; the others were scattered around. No preparation had been made in advance for placing the lamps. Everything was done in the 35 minutes. If any person can beat that record I would like to hear from them.

After these lights were started it was found necessary to extend the line about 200 feet for an additicnal lamp; also to extend in an opposite direction for two additional lamps. These additional lamps and the wire were connected while the remainder of the lamps were burning, and this was done without shock to the person making the connections. The lamps are connected in series.

The Electric Light in Night Attacks.

An important experiment in night attack was made recently near Portsmouth, England, the primary object of which was to ascertain whether by means of the electric light it was possible to see and identify bodies of troops moving in the dark sufficiently well to fire at them. The objective points were Forts Grange and Rowner, forming part of the western defenses guarding the land approach to the garrison and dockyard. As color test under the electric light, blue coats, red coats, and overcoats of various hues were worn. As soon as the men told off for the attack began to move, a powerful beam was projected from the parapet of Fort Rowner, and it thoroughly exposed the positions, notwithstanding that the film of smoke produced by the defenders' own artillery crossed the ray. The red uniforms were very distinct, the least conspicuous colour being blue. What still further contributed to disclose the continually changing position of the attacking force was the flash of the musketry and the jets of smoke from the firing, which, illuminated as they were under the electric beam, hung suspended like opaque clouds in the air.

Resistance Coils for Use with Alternate Currents.

In a paper read before the Société Française de Physique M. Chaperon recently described a method of winding resistance coils so as to enable the Wheatstone bridge to be employed in alternate-current work. With a telephone instead of a galvanometer, a balance, when the present form of coil is used with alternating currents, is denoted merely by a minimum of sound, not by complete silence, so that any approach to accuracy is impossible. M. Chaperon, in common with Kohlrausch, Cornu and others, was inclined to attribute these disturbances to electrostatic rather than to inductive effects. He therefore first of all experimented with two coils identical in every respect except that one was wound as a solenoid and the other like the coil of a resistance box. Much better results were obtained with the former than with the latter, although, of course, the self-induction was much greater in the first case. M. Chaperon, therefore, while taking care to have inverse currents in the adjacent portions of his coils, endeavors to diminish electrostatic effects by arranging

matters so that the difference of potential between these adjacent portions shall be a minimum. This is effected by winding the coil in several sections and taking the greatest care to keep the thickness of the insulation rigorously equal in every part. M. Cornu, who assisted M. Chaperon in these investigations, says the new form of coil gives excellent results.

Mr. G. W. Mansfield on Electric Traction.

The Thomson Electric Club, of Lynn, has now made a good beginning, and on Tuesday night, June 18, gave its members a rare treat in the shape of a lecture on "Electric Railroads," by Mr. George W. Mansfield, of the Thomson-Houston Electric Company, Boston. Mr. Mansfield required no introduction to the electrical fraternity, but there being present many ladies and gentlemen not engaged in electrical pursuits, Mr. Vice-President Rice performed that kind office for him. In opening the subject, Mr. Mansfield gave a short history of the ordinary street car. It was somewhere in 1670 that the first street vehicle was drawn about on wheels, but was given up as a failure. One hundred years later iron rails were tried and also discarded. In 1827 the Baltimore & Obio "horse car" line was opened up, a short distance being covered, and f om this has grown wonderful results. Mr. Mansfield then traced the experiments in electricity, beginning with the present century.

This has been the age of steam, and the steam engine was pushed forward to its successful position of to-day as the ideal means of furnishing power for all purposes of propulsion. As a means of street propulsion, however, Mr. Mansfield stated, steam is a failure, always has been a failure and always will be a failure. In the sixties Moses Farmer experimented with a street car motor and proved its practicability, using the Gramme ring with more or less success. The first street railway was operated in 1832 from New York to Harlem, and to-day there are twenty-five thousand cars in use on the streets of cities in the United States requiring the services of 180,000 horses. In 1856 the first street car was operated in Boston a distance of three miles, though great opposition was met with. Boston to-day operates the largest street car service in the world, one hundred and ten million persons being carried over the rails in one year. To meet the problem of a more rapid means of transit has come in the electric railroad, steam having proved a failure on the streets. Since the introduction of electricity in various places, the principal objection raised is to the trolley wire overhead, and attempts have been made, though not very successfully, to put the wires underground. In Lynn the overhead line meets with little or no objection now, and in Boston the city government has granted the petition of the West End Railway for permission to operate all its line by electricity. Street cars run by electric motors can be kept in constant operation 24 hours, while cars run by horses are changed every four hours. People can reach their homes in the suburbs in one half the time consumed by horses, andas a means of permitting the population of crowded cities to enjoy the pure air of the country, it is in the interest of health and morals that such a means be provided. With the electric motor, also, trains of three or four cars can be run at a high rate of speed, something impossible to do with horses. The Thomson-Houston Company has about 50 street car lines in operation to-day, and railway men from far and near are considering this system of transit. Mr. Mansfield closed his plea for electric railways amid hearty applause, and Mr. Rice announced the meeting open.

In answer to a question as regards speed, Mr. Mansfield said that 30 miles an hour was readily obtainable. Mr. Mansfield then, in answer to another question as to storage battery system, stated that the history of storage battery was not particularly brilliant. President Whitney had spent thousands of dollars but had not been successful. Thirty miles a day without recharging was the best it could do steadily, and a 6 per cent. grade was sufficient to tax its powers to the uttermost.

Mr. Mansfield replied to a question of danger in touching a broken wire, that it was quite impossible to get hurt from 500 volts, the pressure which they used. Mr. Mansfield also referred to the double trolley system, but stated that owing to the multiplicity of insulators, frogs, etc., especially at the crossings and junctions such a system was not yet thoroughly practicable. As to induction on telephone wires, the telephone company had all the safeguards necessary, and it only required the expenditure of a little money to apply them. Mr. Mansfield's lecture was listened to with the greatest interest and appreciation by the large and intelligent audience.

Hering Vise-Grip Wire Coupling.

Not less important than good insulation is proper installation. One of the greatest facts in connection with this latter subject is the reduction of the line resistance to the lowest possible degree. Wire joints as ordinarily made offer 50 per cent. of the total line resistance. With this issue we have illustrated an extremely ingenious wire coupling devised by Mr. Carl Hering, in which the conditions which exist in a first-class wire joint are attained perfectly by a clamp which operates purely upon mechanical principles. The clamping is so extremely tight that the molecules of the materials are forced into intimate connection, and there is no resistance offered by the joint whatever. The ingenious methods by which these objects are attained are shown in the illustrations herewith: Fig. 1 shows the coupling only. Fig 2 shows the coupling with wires run through and ready to be fastened. Fig. 3 shows the coupling with wires properly fastened, in which the wire is tightly gripped, and the joint is perfect and neatly made for permanent use. Fig. 4 shows the coupling same as Fig. 3, with the exception that the ends of the wire are twisted around and furnish additional fastening. This makes the grip of the wires extremely vise-like, and there is no danger of their ever coming apart. The wires and joining parts are virtually welded together. The operation is so quick and simple that there is a great saving of time over the usual "twist joint." A very great saving of time is also made over the ordinary soldered joint, of which it is a practical equivalent in low resistance and strength.

They are made of stiff copper and in every way suited to the purpose for which they are designed. No special tools are required in their manipulation. The ordinary pliers in the smaller wires, and the hammer in case of larger wires, are the only implements required. They are adapted alike for electric light wires, telephone and telegraph wires They are manufactured and offered for sale by the Electrical Supply Company, of Chicago.

Second Anniversary of the Boston Electric Club.

Last Friday night a large number of gentlemen met at the club-rooms to celebrate the second anniversary of the inauguration of the Boston Electric Club. A very pleasant, social time was spent in general conversation, while

FIG. 1.—HERING VICE-GRIP WIRE COUPLING.

a few availed themselves of the privileges of the billiard room. Music was provided for the entertainment of its guests by a pianist and vocal quartet, which added materially to the success of the evening. The club-rooms are well adapted for an entertainment of this kind, and being on the third floor form extremely comfortable quarters even on the warmest nights, a cool breeze passing through them at all times.

About half past nine an excellent cold collation was served in the reading room up-stairs, which certainly did credit to the culinary department of the club, as every one appeared to partake of the good things set before them with zest and appetite. A large punch bowl containing an excellent concoction of claret punch was also well

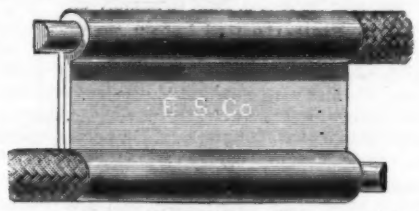


FIG. 2.—HERING VICE-GRIP WIRE COUPLING.

patronized, and helped to impart good cheer and fellowship all round.

After the service of coffee, an adjournment was made to the club-room, and the gentlemen were called to order in facetious terms by President Denver. With a few happy remarks suitable to the occasion Mr. Denver called on Mr. Frank Ridlon to address the meeting. Mr. Ridlon in his usual neat manner recalled the birth of the Boston Electric Club, and the feast of reason which they had enjoyed on that occasion. The Boston Electric Club has now reached the point where all the world will recognize it. The South and West, and even Texas were beginning to copy Boston. In conclusion, Mr. Ridlon congratulated the club on its success, and hoped that it would go on increasing until it stood on a par with The Franklin Institute, of Philadel-

FIG. 3.—HERING VICE GRIP WIRE COUPLING.

phia, gathering in data for the future growth of electricity everywhere.

The Chairman, after paying a warm compliment to Mr. Ridlon's capabilities as a business man and speech maker, called on Colonel Ranson for a few words.

Mr. Ransom doubted if he could add anything to the story of the birth of the club, after it had been so ably told by the friend of all, commonly known among electricians as "Father McGlynn." They were all proud of the Electric Club and took an interest in all its movements. Boston is a city of clubs, more so than any other city, and, though chiefly instituted for social purposes, yet many business men were attracted to them, when they had an opportunity of meeting members of all industries. Mr.

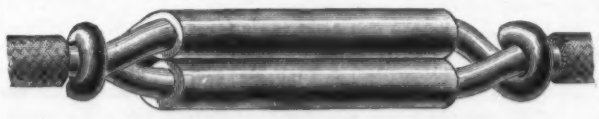


FIG. 4.—HERING VICE-GRIP WIRE COUPLING.

Ransom then went on to speak of the introduction of the New England Insurance Exchange and the good work it was doing from an electrical point of view, and said that there was cause for new hope and new pride in such an institution being in their midst. Under this new régime it was a matter of certainty that electric light could be furnished without hazard.

Mr. Cram was next called on for a few remarks, and acknowledged that he felt great pleasure in being present, and honored in being asked to speak. Mr. Cram indorsed Col. Ransom's statement that the club was doing good work but suggested its usefulness and popularity might be greatly increased by having a club library. He had been advised that there was no reference electrical library in Boston, that the Athenæum had made an effort but that it was very incomplete. The electrical profession had need of such a library, and he hoped that Boston would soon have one, and that the Electrical Club would provide it. It would serve to attract new members, which the club was desirous of reaching. A fund might be started for the purpose, and a small beginning made, until finally the Boston Electric Club would be possessed of a perfect library.

Mr. Barton was next called on, and spoke a few words from the insurance standpoint, and the origin of the New England Insurance Exchange. Its influences are being felt not only in Boston, but all over the country. One of the few things he was proud of was his connection with electricians and his presence at the inauguration of the Boston Electric Club. Mr. Barton stated also that he felt great pride in the harmonious and pleasant relationship which existed between the New England Exchange and electricians and underwriters, and he took a personal pride in being in a position where his advice was sought after and information requested, even from Canada, as regards the requirements of the exchange.

Following the subject of insurance, President Denver next called on Captain Brophy. The Captain expressed the great pleasure he felt in being one of the original members of the Boston Electric Club. When he first became connected with the New England Exchange, he feared disagreeable duties, and that he would be looked upon as one who could not possibly be tolerated. He had been agreeably surprised. First he was looked on as a "pretty fair sort of fellow;" then people said: "We can get along with him, but we wish he was out of the way;" and now he was looked upon by all as a friend. Wonderful transition! Wonderful change! It was a matter of thankfulness that there should be the best of feeling between the underwriters and the electrical fraternity. There was no man to-day in electrical business who cannot feel proud at the rapid progress made in his profession. Capt. Brophy also felt proud of being a member of the Electric Club, and every man ought to feel proud of belonging to a club which had as a member such a man as Prof. Elihu Thomson. Captain Brophy then closed by saying that as a traveling man he used the club for relaxation, and he trusted that each and every member would resolve before entering to throw aside all bitterness of business engagements, and none but friends be found inside this hospitable door.

Mr. Wilson then addressed the members on the advisability of providing a library for the club. It had been much talked about but little progress had been made. He hoped soon now to make a start by providing the home and foreign magazines, the illustrated papers, and all the Boston daily papers, with probably a few of the New York and Chicago papers

The chairman here made the remark that he thought the age would produce far greater inventions than the telephone, and that electricity would yet accomplish things far above any living man's expectations. He then called on Mr. Neale for a benediction, who duly responded:

Among those present were the following: Wm. J. Denver, R. F. Ross, F. J. Boynton, J. R. Lovejoy, C. W. Holtzer, G. F. Spiller, Geo. B. Neale, H. Brown, Jr., P. Coyle, Sam Elder, Ed. Blake, Wm. O. Weber, Winthrop Thayer, John Post, Jr., Herman Bergholtz, Merle J. Wightman, C. M. Ransom, A. C. Adams, Wm. D. Warner, Providence; O. K. Stuart, Lynn; Dr A. de Bausset, Chicago; G. A. Frei, W. C. Underwood, New Bedford; J. Dean, Jr., S. J. Stone, F. E. Pettingell, D. Killecutt, Frank Ridlon, James R. Magee, S. G. Barton, Lawrence J. Ford, W. B. Pettingell, Capt. Wm. Brophy, W. E. Stow, A. B. Grigg, A. C. Shaw, W. S. Key; Ernest Buck, Baltimore; E. M. Carhart, Providence; W. S. Gorton, Lynn; Gilman B. Bolton; Chas. H. Herrick, W. H. Moore, H. B. Cram, C. S. Haley.

The Bangor, Me., Municipal Brush Electric Light Plant.

The subject of municipal lighting by electricity is one which has caused many interesting discussions, and the description of the city electric light plant in Bangor will, therefore, be of interest to many. This city had many special advantages for a municipal plant. About one and a half miles from the centre of the city, on the banks of the river Penobscot, are situated the water works, which furnish the entire city with water. Until a year ago the water was forced into the mains by a 3,000,000 gallon pump, operated by three powerful turbines, but at that time it was found necessary to increase the supply of water. Accordingly, a new set of turbine wheels and a new 5,000,000 gallon pump was put in for the city service, leaving entirely idle the three old turbines, with complete outfit of gate pits and main driving shaft. Mayor Bragg and Aldermen Taney, Maxfield and McLure, were the moving spirits in the matter, but met with bitter opposition on the ground that there was not sufficient power at the water works; and an engineer employed by the opposition gave an unfavorable report. In order to settle this question beyond dispute, Mayor Bragg called in the services of Mr. Francis, of Lowell, Mass., one of the best hydraulic engineers in the country, who reported that there was ample power for the purpose. Mr. Fred Whipple acted as consulting electrician and engineer, and furnished specifications for the complete work. The Mayor and Mr. Whipple, assisted by the council, located carefully all the lights. There were five bids considered, and the Brush Electric Company came out as the successful competitor, their bid being $25,909 for 165 arc lights.

It may be interesting here to note the pecuniary reasons which influenced Bangor to have a plant of its own for street lighting. The city has been paying for 24 arc lamps of 1,200 candle-power the sum of $150 a year per lamp, furnished by the local Thomson-Houston Company; 126 street gas lights at $30 a year, and 74 globe naphtha lamps at 7½ cents per night. This amounts to about $9,000 a year. The local electric light company offered to light the city by means of 24 arc and 240 incandescent lights, and their bid amounted to about $8,400 a year. It is estimated that the plant just put in can be operated for about $5,000 a year, probably less, showing a clear saving even when the interest on the capital is added.

As before stated, the motive power is water, with a head of from 8 to 15 feet at ordinary tides. The only trouble that has arisen with the water wheels in the past consists of anchor ice in the early spring freshets, but 16 hours is the longest time they have ever had to shut down on account of it. The wheels are 84-inch "American" turbines, built by Stout, Mills & Temple, of Dayton, O., some 10 years ago. There is one straight line of shafting in the wheel room, extending into the pump room, now also the dynamo room, with two turbines geared directly under it. A third turbine can also be geared on to this shaft by means of a mitre wheel on the end of a a shaft lying at an oblique angle to the main shaft, but it is not expected that this wheel will ever be required. Each wheel is capable of giving out from 75 to 150 h. p.,

according to the tide, and to preserve a constant speed, two snow improved governors have been geared on to the wheels with a hand shaft, connecting with the dynamo room, for starting and regulating by hand if required. The main shafting is 6 inches in diameter, and was formerly connected rigidly to the large pump, and also to the auxiliary engine at the other side of the pump. In order to run the electric plant without moving the pump, a friction clutch coupling, capable of transmitting 175 h. p., has been introduced, and now the electric light plant can be run entirely independent of the engine and pump. To acquire the necessary speed at the dynamos two countershafts have been used. On the main shaft, which makes 36 revolutions per minute, is keyed a mortised spur wheel $80\frac{33}{100}$ inches diameter, having 63 wooden teeth of 4 inches pitch and 12 inches face. This wheel gears direct into a cast-iron pinion $24\frac{19}{100}$ inches diameter, with 19 teeth, 12 inches face, which is keyed on to the intermediate countershaft of 6 inches diameter, making 119 revolutions per minute. On this shaft is a large friction clutch pulley 68 inches diameter and 36 inches face, which drives by means of a 33-inch leather belt the main countershaft attached to the ceiling overhead. The drive is an oblique one, and the belt is about 65 feet long, the pulley on the main countershaft being 30 inches diameter and 36 inches face. This countershaft is about 52 feet long, and is supported by two wall boxes and five hanger brackets. It is $4\frac{1}{2}$ inches in diameter, but is increased to 5 inches at the end where the large driving-belt is, and makes 265 revolutions per minute. By means of ungearing the friction pulley on the intermediate shaft, the engine and pump can be operated without moving the main countershaft or the large driving belt. On the main counter-shaft are three driving pulleys, two of which are 60 inches diameter by 14 inches face, and one 60 inches diameter and 12 inches face. Each pulley is provided with a friction clutch, so that the dynamos do not turn until the engineer in charge puts them in gear, and each works independently of the other. A rod hangs down from each clutch to within a reasonable distance of the main floor. On the end of the counter-shaft there is provided an extra pulley of 22 inches face and friction clutch attached, which can be used as a driving pulley, as it is the intention to put in an auxiliary steam engine in case of any trouble with the water wheels. The trusses of the building have been greatly strengthened and augmented to provide for the increased weight and strain on the ceiling. There are two No. 8 Brush dynamos giving 60 to 65 lights of 2,000-candle-power, and running about 875 revolutions per minute, and one No. 7½ 50-light dynamo running at 1,025 revolutions per minute. The dynamos are placed on solid brick foundation 6 feet deep, which rests on concrete on top of the solid rock, and are mounted on strong wooden beams supporting the sliding frame of the dynamo. A Schaefer & Budenberg tachometer has been provided, and is geared to the dynamo nearest the starting gear. Near the dynamos, current governors or regulators, one for each, are screwed to the wooden lining of the walls, and are mounted on porcelain knobs. Each dynamo is also provided with an ammeter, which marks the current in tenths of an ampere. The wires from the dynamo to the switch-board on the other side of the room are carried under the floor on glass insulators sitting upright so as to shed water in the ordinary way. Wherever they penetrate the floor, glass floor insulators are used with a hard rubber tube inserted, and everything has been done to meet the rules and regulations of the New England Board of Fire Underwriters. The switch-board is 9 feet by 6 feet, and is made of black walnut and hard pine oiled and finished.

It has provision for four circuits, three actual outside circuits, and one extra or testing circuit. The dynamo cables are soldered on to the dynamo wires at the back of the board, and are provided with wooden handles with a brass ring at the end. This ring is jammed into a forked terminal when the circuit is closed, and forms a good and quick means of making connection. Lightning arresters are provided for each circuit, and a magneto bell for testing is affixed to the board. The belting throughout was furnished by Charles A. Schieren & Co., of New York, the makers of perforated belting, and the countershafting and friction clutch pulleys were provided by the Hill Clutch Works, of Cleveland, O. Hinckley & Egery, a local engineering firm, contracted to erect all the machinery.

In the work of outside construction about 800 cedar poles, varying from 30 to 35 feet high, supplied by Nealley & Co., of Bangor, have been used, and over 40 miles of black waterproof wire have been required for the three circuits, one alone of which uses about 20 miles of wire. There are in all 141 lamps of the ordinary double carbon, 2,000 candle-power type, divided into three circuits, and, with the exception of seven, they are all suspended on Brady mast arms, 102 of which are 22 feet long, and the remainder 16 feet long. The poles for the lamps are 40 feet high. Where four pin cross-arms are used iron straps have been provided as braces, and where the wire turns corners iron guards are placed over the insulators. All joints in the wire are soldered and insulated with Grimshaw tape. Considerable obstruction was met with in the enormous number of trees in Bangor, and it was found also in many cases the holes for the poles had to be made by blasting the solid rock with dynamite.

The lights were started up on Wednesday, June 19, a few minutes after eight o'clock, and have given entire satisfaction to the citizens of Bangor. It is probably now one of the best lit cities in the Union for its size, and one can drive miles in the city and suburbs, and be all the time under the silvery ray of the electric arc. The careful location of each light can now be fully appreciated, and Bangor is to be congratulated upon having as a Mayor a man of such indefatigable energy as Mayor Bragg, who succeeded in the face of all opposition in providing the city with such a brilliant means of illumination. The Brush Company are also to be congratulated for having carried out their work in such a thorough manner, under the skillful supervision of Mr. C. P. Phipps, of New York, assisted ably by Mr. Cross, and providing Bangor with a light which, even on the first night, shone out with a steady and unvarying brilliancy. "Lovers of the darkness rather than the light" will find no abode in Bangor, and peace-abiding citizens may sleep securely in the knowledge that they are safer than ever from marauders by means of the quietly penetrating rays of the light on the corner, produced indirectly from the waters of their own well-loved Penobscot River a few miles above.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, June 24, 1889.

Mr. A. Van Winkle, of Hanson, Van Winkle & Co., Newark, and 92 Liberty street, New York, manufacturers of dynamos for plating, as well as chemicals, anodes and electrical supplies of all kinds, is now at the Paris Exposition representing the company. He expects to return about July 15.

The Easton Electric Light Company, of 120 Broadway, have secured a franchise from Belfast, Me., and are erecting a 100-arc plant immediately. The company have just built their factory at Newark, and they have brought out a new dynamo and lamp of the style to be installed at Belfast.

Mr. L. M. Wilcox, 211 Mulberry street, Newark, manufacturing electrician, was very busy when I called in the other day finishing a new motor of compact and neat form. He has also just completed a big and handsome 225 number annunciator for a hotel in Schooley's Mountains. Mr. Wilcox gives special attention to experimental work.

Mr. Harry Hall.—On June 12, Mr. Harry Hall was married in Brooklyn to Miss Van Vorst, and last week I had the pleasure of meeting the happy couple at their residence in Brooklyn. Mr. Hall, who is well known in electrical circles, is now with the enterprising concern of Hazazer & Stanley, at whose headquarters his old friends will find him zealously attending to business.

The Vitrite and Luminoid Company, at Harrison, N. J., are, I found when calling in the other day, still awaiting the decision of some knotty point at law which will enable them to go on with their manufactures. They have a splendid plant for the manufacture of lamps, and hold a number of testimonials as to the life of the lamps, some of which have a record of no fewer than 1,740 to 2,200 hours.

The Big Plaza Hotel.—For a long time past there has been a good deal of talk as to the plant to be installed in the huge Plaza Hotel, at the entrance to Central Park. The problem has now been solved by Mr. C. A. Benton, who has secured the contract from McKim, Meade & White, the architects employed by the New York Life Insurance Company, the owners, to furnish a complete Edison plant, including four 725 16-c. p. light dynamos.

Mr. John S. Hall, the well known manufacturer and inventor, of 40 Cortlandt street, has just returned home from a trip through California, the Northwest, Minneapolis, St. Paul, Chicago, St. Louis, etc. He met with a cordial reception everywhere, his oil cups and lubricators having admirably paved the way for him. He visited a great many electric light local companies, manufacturers of dynamos, motors, etc., and enjoyed splendid success everywhere.

The Weston Electric Instrument Company, of Newark, have just completed their new meters, and are preparing a new stock for their numerous customers. These instruments are beautifully made, and can be thoroughly depended upon for measurements and for their permanent readings. They have been thoroughly tested, and no difficulty on that score need be apprehended. There is no worry on the score of calibration, either. They can be kept in circuit constantly without anxiety, and by a simple attachment can be cut into and out of circuit immediately.

Mr. I. Everson Winslow, the electrical engineer who has had entire charge of the construction of the Bangor electric road, was born in Brooklyn, N. Y., and was graduated from the Brooklyn Polytechnic Institute. He entered mercantile life, but finding that distasteful to his strong mechanical inclinations, abandoned it and took up electrical engineering as a profession, under the auspices of the American Electric Light Company. He studied electric motors and power under Daft and then entered the employ of the Thomson-Houston Company. He has superintended the building of several electric roads, though only 23 years old.

The Atlantic Watch Case, whose merits I have more than once enlarged upon already, is anti-magnetic. In other words, it will not receive or retain magnetism. It is made in all sizes to correspond with the sizes of the movements, and the best movements are safe in it as well as the cheapest. Its pride is such as to bring it within the reach of every one connected with electrical pursuits. Its appearance is faithfully represented in the illustrations which appear in the advertising columns of your paper. One advantage of the case is that the time is always visible through the unbreakable bevel glass front which is inserted in all sizes.

Mr. Jean Tack, 215 Market street, Newark, is known as "the jeweller" in Newark. It is natural that so progressive a man should be interested in electrical matters, and he has a fine C. & C. motor in his window, surrounded by all the latest patterns of Paillard's handsome non-magnetic watches. These watches have received the testimony of leading electricians as to their qualities of resistance, and endurance when placed in the strongest magnetic fields and under the most adverse conditions; and, as Newark is such an electrical city, I have no doubt that the demand for them is quite brisk. The home office of the Non-Magnetic Watch Company, by the way, is at 177 and 179 Broadway, where every facility is furnished to dealers and buyers of these goods.

The Edison Lamp Company, of Harrison, N. J., have recently assumed entire control of the business in small incandescent lamps and those of low voltage made under the Edison patents. The varieties of lamps made will include those for physicians, experimenters, etc., and the company will pay great attention to the use of their lamps for decorative purposes wherever current can be obtained from stations or from isolated plants. Mr. W H. Meadowcroft has this department under his supervision. Under the new régime the department is ready to consult and advise with all parties desirous of decorating or beautifying with such lamps halls, theatres, public places, houses, etc., for special occasions or for permanent use. They will receive and carry out plans and specifications, or will furnish the same for temporary work of this nature. They are also prepared to undertake specially such elaborate pieces as were shown during the late Centennial.

The New American Electrical Arc-Light Company, of 18 Cortlandt street, has issued a notice to the public stating that it has acquired complete ownership of the Fuller-Wood patents and the machinery for manufacturing under them, formerly held by the late American Electric Manufacturing Company, and that they are prepared to furnish all necessary apparatus for arc lighting under the American system and defend their customers in the use of the same. With regard to this system the Edison Electric Light Company, of New York, say: "We believe the American arc light to be the very best now in existence, our citizens are proud of it and boast of their well lighted city." The New American Company acquired the right of the Fuller-Wood at the receiver's sale, some two months since. The management is composed of old directors of the American Electric Manufacturing Company, who are anxious to secure their investments and propose to continue the business under brighter auspices. Mr. Chas. E. West is treasurer and general manager, and I learned from a conversation with him last week that the new company are in a fair way to success, as nearly all those using plants installed under the American system speak in the highest terms of the operation of the apparatus, and in many cases desire to increase their equipment.

The Excelsior Electric Company, 115 Broadway, started up in a very successful and promising manner a few days ago their new 200-arc plant at Harrison, N. J., furnishing lights to East Newark, Kearney and Arlington. Kearney was formerly lighted by the Thomson-Houston station at Newark, but that station is now too overloaded with orders to attend to outside contracts, and thus could not any longer furnish the current to Kearney, which, however, is well pleased with the service it is obtaining under the new conditions. A pretty feature of the starting of the plant on June 17 was the fact that the two Misses Coyle turned the valve that furnished steam to the engine, and the two Misses Kerr turned the switches that closed the circuit to the lamps. These young ladies are the daughters of officers of the city of Harrison, and their participation in the proceedings gives an idea of the popular interest in the plant. The capacity is to be increased at once to 300 arcs and 2,500 incandescents. There are 6 dynamos driven by 3 Armington & Sims' engines, installed by E. P. Hampson & Co. Hewes & Phillips, of Newark, furnished the pumps, and A. B. Laurence furnished the belts. Mr. Jas. McLane is the electrician in charge of the plant. The Excelsior Company will also start up their new plant at Stroudsburgh, Pa., in about two weeks with 45 arcs and 600 incandescents, the dynamos being driven by Ide engine and boiler.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, June 22, 1889.

Mr. J. B. Crouse, of the Standard Carbon Company, of Cleveland, was in the city last week for a few days.

Mr. Samuel Elder has been appointed general eastern agent of the Standard Carbon Company, of Cleveland, O., with headquarters in this city.

Lawrence, Mass.—It is stated that millionaire Searles proposes to set up an electric light plant in this city, having purchased the Methuen woollen mills for the purpose of providing a station.

Nantucket, Mass.—The old skating rink, which has served its day and generation, will now be used as an electric light station, an electric plant being about to be established in that city very soon.

Salem, Mass.—The city government having refused to settle with the local electric light company, the Norfolk County Electric Light Company, using the Westinghouse system, have applied for a franchise, and secured a hearing.

Frank Ridlon & Co.—Mr. Ridlon is no longer a scoffer at the efficacy of advertising. He has had an inquiry for his church pipe organ, and bids fair to make a successful sale. If he does there will be "music in the air" for his friends in Boston.

Chelsea, Mass.—The contract for extending the electric light in Chelsea has been secured by Kendal & Slade, this city. The contract calls for 150 arc lights and 150 incandescent lights of 25 candle power, and was given by the city government to the Chelsea Gas Light Company, who made the sub-contract.

The Simplex Electrical Company continue to do a large business in their specially insulated wires, and Dr. Mason tells me that Mr. Cutter, of Chicago, has already developed a large business all over the west. The large order for St. Louis which the Simplex Company secured about a month ago was got mainly by Mr. Cutter's work, and the Simplex Company are now shipping the wire by the car load.

Grant, Pearson & Co.—The firm of Grant, Pearson & Co., of this city, has been dissolved by the retirement of Mr. F. S. Pearson, who has been engaged by the West End Railway Company in connection with their electrical department, his large experience in electrical matters well qualifying him for the position; the agency of the McIntosh & Seymour engines will be conducted by the other members of the late firm under the name of J. A. Grant & Co.

Bar Harbor, Me.—Mount Desert does not intend to be left in the lurch in the matter of electric railroads. The Railroad Commissioners have been asked for a charter for an electric railroad to connect the village of Bar Harbor with the foot of Green Mountain, so as to join with the mountain railway. Visitors go to Bar Harbor for recreation and rest, and they propose to take things as easily and comfortably as money and science can provide for them.

The Plymouth and Kingston Street Railway Company will get in complete operation next week. The road is four and a half miles long, and is equipped with five single trolley Thomson-Houston cars, two of which are tow cars. Though there are some heavy grades and sharp curves encountered, they are successfully overcome by the motors, even when the cars are fully loaded with passengers. The Electric Light Company supply the current.

Mr. John C. Enos, President of the Beacon Electric Company, of Boston, has been, along with others, considering a proposed route between Plymouth and Wareham on which to locate an electric railroad. The distance is 16 miles, and the projected road will be of standard gauge. Steamers are to connect at Wareham for New York and at Plymouth for Boston, the intention being to carry on a freight and passenger traffic, competing with existing lines and avoiding the dangerous sea voyage around Cape Cod.

Spencer Damper Regulator.—Mr. G. G. Stillman, agent for the Spencer damper regulator in this city, reports the following sales: Continental Bank, Boston, Mass.; Hotel Flower, Boston, Mass.; Boston Transcript Company, Boston, Mass.; Pratt Building, Boston, Mass.; North Easton, Mass., Water Works; Pawtucket, R. I., Gas Company; Wanskuck Mill, Providence, R. I.; Glenark Knitting Company, Woonsocket, R. I.; Otis Bros., Yonkers, N. Y.; Metropolitan Life Insurance Company, New York City; F. & M. Schaeffer, New York City; Elevated Railroad, Hoboken, N. J.; Hackensack Water Works, Milford, N. J.

Plymouth, Mass.—It appears that the telephones which were reported to have been highly satisfactory to the people in this city have not yet left the factory of the Pulsion Company, and that no wire has yet been strung in Plymouth by that company. The city, which has been using both gas and electric lights for the past three years, has adopted electricity altogether this season. The Electric Light Company have entered into a contract, commencing July 1, to supply 1,200-candle power lights on the main thoroughfares, and 32-candle power series incandescent lamps on the less important streets. Each incandescent lamp will replace a gas lamp, and a much larger area will be illuminated by additional lamps.

Electrical Storms.—As a result of the recent electrical storms so severely felt in this section of the country a number of cities have had their electrical apparatus damaged in various ways. In Pittsfield, Mass., over 100 telephones were burned out, and a number of telephones were also destroyed in Malden, besides ringing in

an alarm of fire, which called out the entire fire department. In Bangor, Me., one of the electric cars was disabled by the lightning passing in through the contact wire. The electric lights in the Opera House, at Hartford, Conn., were burned out, and telegraph communication was impaired all over. Nearly every city suffered more or less by lightning, and it was clearly demonstrated that there is plenty of opportunity for inventors in producing a better preventive against this subtle foe.

Electric Railroad Interests.—The officers of the South Park and Crosstown Street Railway Company, of Rochester, N. Y., together with the Executive Board of Common Council and the members of the Street Railway Committee of the Common Council, were in Boston the latter part of this week for the purpose of investigating the overhead system of electric railways. Mr. Norman McCarty, of the Thomson-Houston Electric Company, accompanied the party from Rochester and looked after their interests while in this city. Thursday was spent in examining the different systems in use here, the outside construction of the plant taking up more attention than the power stations. Friday was spent at Lynn, Mr. McCarty showing them over the enormous factories of the Thomson-Houston Company. In the evening the visitors were entertained at the Algonquin Club by President Whitney, of the West End Railway Company, and cards of invitation were sent to the representatives of the West End Company, the Railway Committee of the Common Council and representatives of the various electric systems. The visitors expressed themselves quite satisfied with electricity as a means of propulsion, and were strongly in favor of the overhead system as seen in Boston. Saturday was devoted to pleasure, and a special boat was chartered for a trip down the bay. Dinner was served at Atlantic Hotel, at Nantasket Beach, and a return to the city was effected about five o'clock, when the Rochester party left for home, satisfied that Boston not only leads the world in its electrical equipment, but that it can also entertain its guests in a royal fashion. Mr. McCarty also entertained this week the representatives of the Camden, N. J., Street Railway Company, who came to Boston at his request to look into the merits of the Thomson-Houston system. A. C S.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., June 22, 1889.

Wilmington, Del.—Bids are out for furnishing the Wilmington Street Railway Company with over 17,000 feet of rail for the new electric line projected for Eighth street, in that city. Motors are being contracted for, and it is desired to have the road running before next year.

Mr. H. T. Paiste, well known for his electrical specialties, who sailed for Europe on the 8th inst., has been heard from by letter. He arrived safely and did not experience any inconvenience from *mal de mer*, but says he will probably have to join the multitude and walk back, judging from his hotel bill, which has just commenced.

Tracy, Hague & Co., the well-known electrical contractors at No. 308 Walnut street, are installing a plant in the brewery house of Messrs. Betz & Kelley, at Kaighn's Point, Camden. The initial installation will only be about 50 lamps, but this will be greatly increased later in the year. Only the best material will be used in the construction, the intention being to make this a model plant in every particular.

C. R. Arnold & Co. gave an exhibition of throwing a search light at their Chester factory last Monday night with very pleasing results. The lamp, which is patented by Mr. Arnold, gives about 6,000 c. p. With this light objects of note for the distance of 1,000 yards were made very distinct. The test was witnessed by a number of people interested, and considerable satisfaction was expressed at the showing.

T. C. Wheaton & Co. have succeeded to the business of Schull, Wheaton & Co., glassmakers, at Bridgeton, N. J. Mr. Wheaton, the senior member of the new firm, is an able and experienced maker of glass goods, and his name alone is sufficient to bring success to the new venture. They expect to put their furnace out of blast in a few weeks, and upon resumption of work in August will enter the electrical field with a new line of specially designed globes, etc.

The Reliance Electric Company, of No. 720 Sansom street, have greatly increased their facilities for repairing electric machines of any character or doing special construction work. They make a specialty of winding armatures, constructing commutators and dynamo brushes, repairing dynamos, motors, arc lamps, etc., and all electrical work of any description requiring expert attention. This is a new move for this company, but the increasing business reported removes all doubt that it is a wise one. W. H. Monkhouse is the general manager and superintendent.

Partrick & Carter, the well-known makers of electrical specialties and supplies at No. 14 South Second street, this city, are about issuing a new and exhaustive catalogue of their goods. In another column will be found their announcement to the trade of this always important issue, which they say is almost ready for distribution. As all their newest ideas in electrical supplies and novelties will be illustrated and fully described, no user of electrical goods, nor, indeed, any person who desires to keep himself informed on the progress of electrical appliances, can afford to be without one. If the reader of this is a dealer and wants discount sheets, he should send his business card, and the request will be heeded as quickly as possible.

The "Brotherhood" Engine.—Work at the Chester Foundry and Machine Company's place, at Chester, Pa., where this favorite type of direct-coupling engine is manufactured exclusively, is both plentiful and brisk. The success which has followed the introduction of a three-cylinder engine on a critical market has more than equalled the anticipations of the inventor and the constructors. The Pullman Palace Car Company have 21 of these engines already in use, and have just contracted for 12 more. Besides these, the United States Government has ordered 32 of the same type for use on board ships of war. Mr. T. W. Stone, the popular and urbane secretary and treasurer of the company, is up to his eyes in business and still he says: "There is nothing especially new. We are busy. In fact, we are always busy, and that gets to be an old story with us."

Horn, Brannen & Forsyth, makers of electroliers and combination fixtures at Broad and Willow street, this city, have just completed fitting up the new building for the Chestnut Street National Bank, and the effect is very strong and beautiful. The directors' room and the coupon room each have a combination fixture of wrought iron, composed of sixteen gas jets and eight incandescent lamps. The arrangement is very artistic, and when fully illuminated the fixture presents a very pretty appearance. On the side walls are arranged eighteen combination brackets, of two gas and two incandescent lamps each, very artistic, in design and also made of wrought iron. In front of the building is hung a wrought-iron lantern, containing four incandescent lamps, while six similar lamps are placed around to throw a flood of light over the massive entrance. The building was lighted for the first time during the week, and the bank directors were delighted with the firm's work.

E. F. C.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, June 22, 1889.

Recent visitors to the city were Mr. Brainard Rorison, Mr. W. S. Andrews and Mr. A. H. Brown.

Eau Claire, Wis., expects to have the Sprague system of electric railway in operation by July 1.

Mr. A. D. Jacobus, of the Pauline Battery Company, Edgerton, Wis., was in the city during last week.

Foree Bain has lately been doing considerable expert service; also has had numerous armatures sent in to be rewound.

F. von Suessmilch, photographer, 71 Washington street, Chicago, is securing prices on a focussing lamp and dynamo.

John H. Finney, representing the Fidelity Carbon Manufacturing Company, of St. Louis, Mo., was in the city during the week.

Ben Friedburg, manager of the Kansas City, Kan., Excelsior plant, was in the city looking up additional supplies this week.

Decatur, Ill., experienced a terrific storm this week that partially wrecked the city electric lighting plant, leaving the town in darkness.

R. de Batz, Lexington Mine, Butte City, Mont., is looking up the different methods of treating refractory gold and silver ore with electricity.

E. J. Ballou is now making his headquarters with P. S. Kingsland, 28 South Canal street, Chicago, and is alive on the question of economy in the use of steam.

H. M. Lyman, formerly with the United States Electric Lighting Company, is now with the Mather Electric Company, No. 11 Metropolitan block, Chicago.

The Illinois Belding Motor Company have opened a handsome new office on the ground floor of the Rookery Building, next door to the Adams street entrance.

M. C. Chase, the rubber manufacturer, Chicago, believes that there will be no great advance in the price of material whether the trust succeeds in holding together or not.

The Edison System was the one finally adopted by the Elgin Watch Company for the large plant referred to in an article in the last issue of THE ELECTRICAL WORLD.

C. C. Warren, formerly western manager of the U. S. Electric Lighting Company in Chicago, is now said to be engaged in an extensive manufacturing deal in San Francisco.

The Milwaukee Equipment Company has been formed for the manufacture of machinery; capital, $2,000,000; incorporators, H. H. Stofford, A. B. Meyers and H. L. West.

Minot Tirrell, manager of the new Omaha Thomson-Houston Electric Lighting Company, Omaha, visited Chicago this week to complete details of addition to his extensive plant.

Ernst Hoefer, manufacturers' agent, Chicago, has lately secured several nice orders for No. 0 hard drawn copper wire for electrical railway purposes, generally in ten-mile lots.

The Lake View City Council granted a franchise on the 17th inst. to the Western Electric Company, Chicago, to erect and maintain an electric system for residence and street lighting.

Mr. E. E. Crepin, treasurer of the Sperry Electric Company and vice-president of the Fort Dearborn National Bank, Chicago, is enjoying a combined pleasure and business tour in France.

Messrs. William Baragwanath & Son, this city, are turning out a feed water heater six feet in diameter, twenty feet in height and of 1,800 h. p. capacity, for a Kansas City company.

The Iowa Phonograph Company, W. Stinson, secretary and manager, Sioux City, Iowa, report bright prospects. Mr. Stinson is especially interested in the question of storage batteries.

The Electrical Supply Company's binder for preserving the numerous catalogues sent out is worthy of special mention owing to its great convenience, and will be furnished to large consumers.

Big Buildings.—Chicago is soon to have two new tall office buildings, one fourteen, the other sixteen stories high. The latter will be known as the "Monadnock." Both will have isolated incandescent plants.

St. Joseph, Mo.—The city plant, consisting of eight 30-light Excelsior dynamos, operated by two Williams high speed engines, will be in full operation within thirty days. It will be a model Excelsior station.

The Thomson-Houston Electric Company have issued a neat little circular giving instructions for operating their motors; also a price list of arc, incandescent and general supplies for electric light stations.

Fred. H. Whipple, of Detroit, having assumed charge of the electrical display of the St. Louis Exposition, says: "We will get up one of the finest exhibitions of electrical novelties that has ever been seen in the West."

The Williams' Engine Works, Beloit, Wis., are mailing to their friends a copy of a catalogue, or, more properly, a treatise on the Williams' engines that will long be retained as a special work of reference by all users of power.

The Consolidated Electric Light Company, Kansas City, Kan., have just purchased an additional 60-arc light Excelsior dynamo and lamps, making their present capacity 210 full 2,000-candle-power lamps of the Excelsior system.

Mr. Francis W. Parker leaves Chicago for England and the Continent on Thursday, June 27, going via steamer "Aurania" to Liverpool and Manchester and thence to Paris, to forward the interests of several large electrical manufacturing companies.

Blue Island, Ill.—The committee on light from the Blue Island, Ill., Council, were entertained at Evanston, Ill., on the 13th inst., by Mr. Fred Horne, of the Excelsior Electric Company. They appeared well satisfied with the excellent showing made by the city plant.

The Edson Fuel-Oil Burner and Construction Company has been incorporated to construct and operate fuel-oil plants for all kinds of steam boilers and furnaces; capital stock $100,000; incorporators, Robert D. Davidson, Stephen A. Douglas and Harlan H. Pech.

Magnetic Iron Ore is the latest addition to the popular materia medica, a mountain mass of the mineral having been discovered near San Bernardino, Cal., that possesses wonderful curative properties, driving away all traces of rheumatism and neuralgia when bandaged to the affected part.

Bloomington, Ill.—The council of the city of Bloomington accepted on June 14 the new electric light plant installed by the Fort Wayne Jenney Electric Light Company. The electrical machinery is all of the Thomson-Houston system. There are 219 arc lamps, and the cost of the plant to the city was $78,000.

James W. Queen & Co., Philadelphia, have issued a circular containing much of interest to visitors to their exhibit at the Paris Exposition, and offering to attend to all details of shipment and to include in same "any photographs or other souvenirs that may have been purchased for private use."

The Sterling Gas Company, Sterling, Ill., have contracted with the Keystone Electric Company, Chicago, to install a Westinghouse alternating system, and will place 200 twenty-five candle-power lamps over centre of street intersections on special fixtures, and 1,000 sixteen candle-power lamps in stores, residences, etc.

Butler, Mo., now lighted by the local Brush company, will probably become a city of the third class in about ninety days, and then will consider the advisability of giving a franchise to a new company in order to derive what benefit it can from competition. It is a question whether two lighting companies could prosper in a town as small as Butler.

Chan Fan Moore, secretary to Chan Foo, Chinese Minister at Washington, and M. C M. Heller, Secretary of the Legation, inspected the Chicago city fire alarm department on Monday last and were highly pleased with all they observed. The Emperor intends reorganizing the fire department in China, and will shortly have fire and police alarms in full operation.

The Chicago Storage Battery Company have secured license to operate under the patents of the Anglo-American Storage Battery Company, on the north side of the Chicago River, more especially in connection with lighting the residences along the lake shore drive. Charles S. Rader, Frank W. Campbell, and William H. King are the interested parties.

The Co-Operative Electric Light Company, of Chicago, have had several propositions under discussion relative to the erection of a station and complete installation of an underground arc and incandescent system of lighting. Though their franchise was obtained on July 2 last, they have practically done nothing thus far in settling on the system to be employed.

Leonard & Izard, of Chicago, are installing an Edison plant of 2,000 16 c. p. incandescent lamps on the three-wire system at Manitowoc, Wis. The contracts call for the wiring of residences as well as business houses, and also for the placing of a large number of street lights. The larger portion of the current passes through submarine cables laid in the bed of the river.

The Thomson-Houston Electric Company issue a set of printed instructions for the guidance of parties installing and operating either their arc, incandescent or motor systems, that are clearly and concisely worded, neatly printed, and convenient in size. The numerous explanatory and descriptive circulars issued by this company have won them a host of admirers.

The Lowe Feed Water Heater and purifier is favorably presented to notice in a neat pamphlet issued by the Pond Engineering Company. This heater has now been in use 12 years or more, and thus stands strictly on its merits. It is in use by several electric light companies, and is well recommended by those who have tried it. The pamphlet contains an interesting description and some useful data.

The New Omaha Thomson-Houston Electric Light Company has issued the following circular, bearing date of May 28, 1889: "To whom it may concern: That owners of buildings may be protected from irresponsible wire men, this company gives notice that the Nebraska Electric Company, of Omaha, is recognized by us as experienced in electric wiring, and, being found competent to do expert work, is under an agreement to strictly follow the regulations established by us."

Club Notes.—E. J. Martin, Decatur, Ill.; Jas. P. McQuaid, New York City; J. O. Rhoades, Omaha; Geo. E. Fisher, Detroit; Chas. H. Rusling, Kansas City; Chas. C. Miller, Fort Wayne; M. E. Baird, Boston; W. J. Clark, Boston; J. K. Bigger, Covington, Ky.; R. E. J. Mills, Cincinnati; Henry Ramforth, Cincinnati; Jno. H. Finney, St. Louis, Mo., enjoyed the hospitality of the club rooms during the week. R. T. McDonald, of the city of Everywhere, smiled on the members to-day and was cordially welcomed.

The National Electric Manufacturing Company, of Eau Claire, Wis., are installing a 500-light transformer outfit for the Bayfield Lighting Company, Bayfield, Wis.; also, a 1,000-light transformer system for the Elkhart, Ind., Electric Light Company, besides which they have an order for 500 lights from Davis & Starr, lumber dealers of Little Black, Wis. The Hayward, Wis., National (Freeman) plant is now running to its full capacity—500 transformers—and additional dynamo capacity is talked of.

Incorporations.—Meyer-Kiehl-Grant Rotary Engine Manufacturing Company, of Chicago; capital stock $300,000; incorporators, Frederick Meyer, Joseph S. Kiehl and Alexander Grant. The Dundee and Carpenterville Electric Light Company, Dundee, Ill.; capital stock, $6,000; incorporators, William Fay, Arthur Knott and Barry Dorley. Lincoln Electric Light and Power Company, Lincoln, Ill., for the furnishing of electric light, heat and power; capital stock, $20,000; incorporators, E. D. Blinn, James T. Hoblut and A. J. Aldrich.

Lodge, Davis & Co., manufacturers of iron and brass machinery, Cincinnati and Chicago, have purchased the entire plant of the Cincinnati Corrugating Iron Company, and will equip the same with the best machinery for the manufacture of their improved engine lathes, iron planes, shapers, upright drill presses, etc., etc. This will give a plant double the size of their present one. They report running full on orders with indications of a large business ahead; also that they will bring out a new milling machine in the near future.

Pierce City, Mo., granted an ordinance, May 9, 1889, to J. Guinney, section 4 of which reads as follows: "The said city hereby rents from the said J. Guinney, his associates and assigns, thirty-six (36), twenty-five (25) candle-power incandescent street lamps, for a term of one year, at an annual rental of eighteen dollars per annum for each and every one of the said thirty-six lamps, or one dollar and fifty cents per month for each lamp as may be termed." Mr. Guinney selected the Thomson-Houston system, but will eventually add an arc light plant.

The Excelsior Electric Company, Chicago office, report the following additions to plants in operation: The Consolidated Electric Light and Power Company, Kansas City, Kan., 60 arc lights, making a total capacity of 210 arc lights. This speaks well for the management, considering that the company has only been in operation some five months. The Thirty-first Street Merchants' Electric Light Company, Chicago, have found it necessary to increase their plant 30 arc lights, making a total of 90 lights, all installed within ninety days. Fifteen arc light motors of the Excelsior make have been sold in Chicago within the past month.

The Thomson-Houston Electric Company reports the following sales: Kingston, N. Y., 1,300 inc.; Austin, Me., 30 arc; Santa Cruz, Cal., 300 inc.; Reedsburg, Wis., 300 inc.; Andover, Mass., 50 arc, 600 inc.; Fremont, O., 600 inc.; Chelsea, Mass., 600 inc.; Hoosic Falls, N. Y., 600 inc.; Kansas City, Mo., 400 inc.; St.

Paul, Minn., 100 arc, 300 inc.; Mitchell, Dak., 30 arc; Janesville, Wis., 45 arc; and the following isolated plants: North Western Cold Storage and Ice Company, Portland, Ore., 80 inc.: George E. L. Keith, Campello, Mass., 650 inc.; Ottawa House, Portland, Me., 380 inc.; International Telephone District and Construction Company, Baltimore, Md., 1,300 inc.

Mr. H. B. Cobb, of the Cobb Vulcanite Wire Company, during a recent visit to Chicago carefully inspected the sections of Cobb wire laid underground some time ago by the city fire alarm department, it being the first lot of Cobb wire ever used underground. He found every foot to be in excellent condition. Originally the insulation was vulcanized under water, and in one section some two quarts of water ran out when the insulation was broken during this inspection. A more severe test could scarcely be thought of, for had there been the slightest defect in the insulation trouble would have occurred at once In this connection it is worthy of remark that Prof. J. P. Barrett, Chicago's city electrician, ever stands ready to give the same opportunity to all makers of insulated wires of special merit that he so cordially extended to Mr. Cobb.

The Lake View City Council granted a franchise on Monday evening, June 17, to the Western Electric Light and Power Company, W. M. Talcott, manager, to erect and maintain an overhead system of electrical conductors for furnishing arc and incandescent lights to residences, business houses and for street lights. One section of the ordinance reads that the said company shall not be compelled to lay its wires underground for the period of five years, and that the city shall be supplied with light at the rate of one-half cent per hour per 16 candle-power light, provided not less than 1,000 lights are contracted for, the city to pay for all fixtures and wiring used. Two thousand candle-power arc lights are to be furnished at $160 and 1,200 candle-power for $130 per year for all night lights. The system has not been selected.

The Electrical Supply Company have just issued a special circular in regard to their new adjustable independent support arc-light hanger. The valuable feature about this hanger is that the lamp is not supported by the circuit wires. These wires will not, therefore, crystallize and break off. The weight of the lamp is supported independent of these conductors. t is simple and has no catches to wear out or break. It is positive in its action and can never get out of order. There are no loose parts. The l.mp can be supported at any desired height, and raised and lowered at the will of the operator. The conductors are automatically coiled about the reels, and everything is shipped complete, ready for the entire installation, including rope, flexible wires, screws, screw eyes and trolley. They are durable and will support five times the weight required.

Thomson-Houston Work in the West. — During the month ending June 13, the Thomson-Houston Electric Company, Chicago, have sold to the following local companies: Alexandria, Minn., 300 incandescent; Pierce City, Mo., 30 arc, 200 incandescent; Plattsmouth, Neb., 35 arc, 600 incandescent; Mitchell, Dakota, 30 arc, 600 incandescent; Wabash, Ind., 50 arc; Escanaba, Mich., 600 incandescent; Neenah, Wis., 600 incandescent; Santa Cruz., Cal., 300 incandescent; Reedsburg, Wis., 300 incandescent; Austin, Minn., 30 arc. The following list embraces a few of the more important isolated plants sold during the same period: Fairbanks Canning Company, Chicago, Ill., 1,000 incandescent; Illinois Steel Company, Joliet, Ill., 200 incandescent; Minneapolis Exposition Building, Minneapolis, Minn., 150 arc, 1,200 incandescent; Martin Ryerson, Chicago, Ill., 50 arc; Schlitz Brewing Company, Milwaukee, Wis., 500 incandescent. The following increases have been made in old local companies: Galesburg, Ill., 35 arc; Janesville, Wis., 40 arc; Cadillac, Mich., 30 arc; Denver, Col., 70 arc, 1,800 incandescent; Helena, Montana, 1,000 incandescent; San Francisco, Cal., 50 arc; Seattle, W. T., 50 arc.

Blue Island, Ill., is located some sixteen miles from Chicago. A few weeks since the City Council called for bids for the erection of a lighting plant and invited every reputable company to send in proposals. The specifications included one 30-light arc dynamo, with 25 double lamps; five miles of circuit material, the poles to be 40 and 45 feet in height, shaved and painted; Candee or Simplex wire; and for hanging the lamps twenty-five 26-foot mast arms of the Star Iron Tower pattern to be used. Also, one New York Safety Steam plant of 35 h. p.; all to be set up and operated for twenty days by an expert. Yesterday the bids were opened by the committee, and the contract awarded to Mr. Fred Horne, manager of the Western office of the Excelsior Electric Company, though his bid was next to the highest tendered. The following is a list of the bids opened and read: Thomson-Houston Electric Company, $6,000; Excelsior Electric Company, $5,945; Waterhouse Electric Company, $5,600; Sperry Electric Company, $5,400; Indianapolis Jenney Electric Company, $5,220; Brush Electric Company, $5,125; Fort Wayne Company (American System), $4,775; Western Electric Company, $4,000.

The Chicago Electric Club had its regular meeting on Monday evening last at the club rooms, Mr. B. E. Sunny presiding. The annual dues of resident members was raised to $24, but a motion to have the same amount apply to non-resident members was voted down. The board of managers will consider the advisability of holding the meetings on some more convenient evening than Monday, as the average attendance is usually small. Mr. C. C. Haskins read an able resumé of the history of telegraphy to the time the first Morse line was fairly inaugurated. It proved unusually interesting, was well received, and Mr. Haskins was tendered a vote of thanks. Chas. D. Shain, now in charge of the Westinghouse interests at Cincinnati, smiled on us for a few days this week. We miss such energetic workers. Charles Cone, of Kansas City, enjoyed the luxury of a P. & B. cigar in the club-rooms on Monday last. G. W. Stockly, president of the Brush Electric Company, Cleveland, Ohio, dined at the club last week with Mr. Alexander Kempt. John W. Taylor, of the Standard Carbon Company, Cleveland, dined at the club rooms Wednesday after a long but unusually successful business trip throughout the South. Geo. F. Card, of motor fame, Cincinnati, Ohio, was entertained at the club by D. P. Perry.

Leonard & Izard recently made an attractive installation in a jewelry house on State street by placing nineteen 3 c. p., six volt incandescent lamps in series in each one of six show cases, four being flat counter and two upright window cases. In the former the wire was placed beneath the upper front molding of the case and the lamps attached in series thereto. In the windows the lamps are suspended from side as well as top. The effect obtained when the current is turned on is attractive as well as unique, and proves an efficient aid in making a rich display. Leonard & Izard are preparing a display of similar sized lamps, using two hundred in all, placing twenty in series and ten in multiple, to be erected in front of the club rooms and to read "The Chicago Electric Club." When the current is turned on it will be a novel sight and may aid in stimulating the desire for similar attractions among the merchants, though the demand now is by no means small, and it is surprising how many of the wealthier class are now consulting the electricians regarding ways and means to make more attractive their displays of goods, especially in dressing and drawing attention to windows, not only at night time, when but few of the fair sex pass by, but during the entire day, when the streets are thronged with ladies. Some time since one window contained a child's play-house, handsomely and completely furnished, even to cooking and heating stoves, and containing tiny incandescent lamps in each room and also in the stoves; the appearance through the mica in the latter case being similar to the effect produced by Col. Sellers' candle. It formed a taking card and drew crowds during the entire day. Another exhibit showed a handsome doll, some three feet in height, dressed to represent Bartholdi's Statue of Liberty and holding aloft an incandescent lamp, while diamonds and other gems sparkled on her garments. In another window a large doll in a handsome ball dress wore tiny lamps in place of diamonds, while rich jewels were scattered about her feet. Another house had the firm name shown in the window by means of tiny incandescent lamps of various colors placed in a billowy mass of delicate white absorbent cotton. The effect was very rich. During the last holidays one firm erected a cottage, church and mill, each some eight feet in height, with mill race, dark forest and roadway, etc., and had the entire exhibit illuminated with incandescent lights so operated as to be extinguished when the children retired to bed and Santa Claus appeared on the edge of the forest with his loaded sleigh drawn by two handsome bucks. Many brilliant effects have also been secured at some of the many social entertainments for which Chicago is noted, incandescent lamps being placed in ices, cakes, fountains, among flowers, etc., and the current supplied from storage cells. Working on a larger scale the Chicago Edison Company is placing groups of 16 candle power incandescent lamps either six in number or nine, in some business houses, each group displacing an arc light. The cost per hour per group is six or nine cents, in the latter case costing a trifle more than the arc lamp which is supplied at seven cents per lamp hour for full 2,000 candle-power. Finally, Denver, Col., proposes to have a grand illumination of 5,000 incandescent lamps on the evening of the fourth of July, and possibly to continue a few nights longer. The displacing of candles in Chinese lanterns, and some of the other dangerous features of illumination, by incandescent lamps is worthy of special note, and the Denver authorities hope to make a grand success of their plans How much grander the effect would have been had the Centennial authorities expended the money allowed for the set pieces in the pyrotechnical display for a corresponding illumination with colored incandescent lights lasting many hours, in place of only a few seconds, and accompanied with none of the dangerous or disagreeable features of firework displays. D.

THE TELEGRAPH.

The Baltimore & Ohio Sale.—A deed was recorded on June 17 between the Baltimore & Ohio Telegraph Company and the Western Union Telegraph Company, whereby the Baltimore & Ohio Company conveys to the Western Union all its right, title, and interest in and to all the telegraph lines and property of every nature and description. The consideration is $1 and the entire discharge of the Baltimore & Ohio Telegraph Company from the obligation to issue the $6,000,000 of bonds provided for in its contract with the Baltimore & Ohio Railroad Company.

Canadian Cable News.—A special dispatch from Ottawa, Ont., of June 15 says: Advices received here to-day from England state that nearly the entire stock, $2,000,000, has been subscribed in England for the construction of a new Atlantic cable, which is to run from the Straits of Belle Isle to a point on the west coast of Ireland. Mr. Dobelle, a wealthy capitalist of Quebec, is the promoter of the enterprise. The Dominion government propose continuing their land line along the north shore of the St. Lawrence to the straits where it will connect with the new cable. The government will hand this line over to the new company, to be held under long lease at a nominal figure. The object is to give to Canada an independent American cable, and the government is encouraging its construction in every possible way. The government has decided not to accept the offer of an English company to lay a cable from the main land in Nova Scotia to Sable Island, for which they had at first agreed to pay an annual subsidy of $10,000 for 12 years.

THE TELEPHONE.

The Federal Telephone Company, of Montreal, has just issued its first list of subscribers, including about 500 names. A special notice states that additional subscribers are being connected up at the rate of 100 per week, and that new lists will be furnished regularly.

THE ELECTRIC LIGHT.

Lonoke, Ark., wants an electric light plant.

McKinney, Tex.—Mr. C. Kurst is in the market for an electric light plant.

North Tarrytown, N. Y.—The trustees have decided to adopt electric lights for the village.

Rockville, Conn.—The gas company is going into the electric lighting business, arc and incandescent.

Mr. W. J. Murphy has secured the control of the gas and electric light plants at Grand Forks, Dak.

The Goldsboro, N. C., Light & Power Company has been incorporated by O. H. Foster, C. A. Ballow and B. S. Jenman.

Lebanon, Tenn.—The Lebanon Electric Light Company has been formed by S. Galladay, S. G. Stratton, R. P. McClain and others.

Putnam, Conn.—The Putnam Light and Power Company controls both the gas and electric light plants, and is contracting for a new power plant.

Rye, N. Y.—The people of Rye are signing petitions for presentation to the Board of Town Officers to have the principal places in the village lighted by electricity.

New York City.—The big switchboard in the Brush station at Elizabeth street took fire one night last week about 11:30, throwing out the circuits. The fire was of brief duration. The damage is put at about $3,000.

Columbus, Miss.—Mr. W. Johnston, secretary and treasurer of the Tombigbee Mills, reports that they have not yet determined on any system of incandescent lighting, but are open to proposals for a 150 light plant.

Peekskill, N. Y.—The Peekskill Electric Light Company has put down a special plant for lighting the State Camp of Instruction with incandescent lamps. This improvement will be greatly appreciated by the visiting regiments.

Massachusetts Commissioners.—A bill was recently passed by the Massachusetts Legislature, providing the board of gas commissioners shall hereafter be known and designated as the board of gas and electric light commissioners.

New York City.—The Park Commissioners of New York opened last week bids to provide an electric lighting plant for the Metropolitan Museum of Art. The United States Electric Lighting Company bid $45,000, the Edison Company $48,247 and the Electric Accumulator Company $50,000. Their consideration was deferred.

Kankakee, Ill.—The Kankakee local company is putting in a 750-light Westinghouse alternating plant. The plant will also include two 45-light arc machines for commercial lighting, and one 45-lighter for street lighting. There will also be two spare machines. Compound Rice engines will be used driving on a 40-foot line shaft equipped with Hill clutches. The new station will be 50 × 100 feet. Mr. W. S. Reed is the superintendent.

APPLICATIONS OF POWER.

Atlanta, Ga.—The Fulton Street Railroad Company's line will be operated by electricity.

Jersey City.—The Pavonia Horse Railroad Company has made application to the Board of Aldermen for powers to operate by electricity.

Newport, R. I.—A meeting of wealthy residents has been held to take action against the proposed electric railroad, on the ground that no road at all is wanted.

Fort Worth, Tex.—The Fort Worth Electric Light Company are running a motor circuit from a Waterhouse arc machine. They have in operation and contracted for 15 h. p. of motors of the Card and C. & C. makes.

Plymouth, Mass.—Parties interested in electric railroading propose to build an electric road from Plymouth to Wareham, connecting with steamers at the two points, forming a shorter line between Boston and New York, and avoiding the route around the Cape. John A. Enos, of Boston, is at the head of the movement. A survey will be made.

The Washington Electric Street Railway Company, of Washington, Pa., has been chartered, with a capital stock of $60,000. The stockholders are L. N. Singley, H. W. Williams and J. S. Ellsworth, of Washington, Pa., and W. A. Stern, I. H. Silverman and G. D. Levy, of Pittsburgh, Pa. At the meeting of the stockholders the following Board was chosen: L. N. Singley, president; I. H. Silverman, secretary, and G. D. Levy, treasurer. The road will be built immediately, and is to include the principal streets of Washington, Pa.

Jamaica, L. I.—Edward M. Field, a son of Cyrus W. Field, has purchased the stock of Col. Aaron A. Degrauw and several others in the Jamaica and Brooklyn Road Company, which owns the turnpike and the Van Depoele electric railroad running between the two places named. The purchase gives Mr. Field a controlling interest, and the company has been reorganized with the following officers: Samuel Spencer, president; H. Schermerhorn, Jr., secretary; and E. P. Bromley, treasurer. The Long Island Electric Company, which furnished the power to run the cars, has also been absorbed by the new owners. An entirely new equipment will be put on the road. Mr. Spencer, the new president, was formerly general manager of the Baltimore & Ohio Railroad.

Lowell, Mass.—The Lowell & Dracut Street Railway Company are building their line with 50-pound Lee rail, and equipping the same electrically for single trolley overhead system in excess of three miles of suburban extension. The line extends from a present terminus of about 1¼ miles of 35-pound tram rail, so that the length to be operated by electricity will be about 4¾ miles. The power will be supplied by an electric light station about 1,500 feet from the nearest starting point. The maximum grade will be not more than 3½ per cent. for three short distances. It is proposed to operate 3 miles of the above for summer business only, and the remaining 1½ for general business in all seasons. The Bentley-Knight Company has contracted to deliver 8 single 20 h. p. motors before July 1 next. The motors are intended to operate six open and two closed cars, also in case of necessity each car shall tow an additional car. The new cars, 14 in all, are now building by the Newburyport Car Manufacturing Company, of Newburyport, Mass. The whole work is under the direction of Mr. W. D. MacQuesten, electrical engineer of the West End Street Railway Company, of Boston. Mr. A. Fals is president of the company; Mr. J. A. Chase, superintendent, and Mr. P. Parker, treasurer.

PERSONALS.

Mr. W. T. Glover, of the well-known English electrical firm of Walter T. Glover & Co., is in this country.

Mr. Edward Weston has come out strongly in a newspaper interview against electrical executions. He considers hanging more humane and natural.

Mr. Henry Edmunds, of England, has, we are very sorry to report, been quite ill with pneumonia at the Fifth Avenue Hotel, but a decided improvement is reported.

Mr. James Frank Morrison, not long since a very sick man, has rapidly recovered health and flesh and was in New York last week full of his wonted energy and good spirits.

Mr. Nikola Tesla has been taking a brief holiday away from Pittsburgh, in New York. He reports highly satisfactory progress with his alternating current motor, and has other interesting work in hand.

Prof. Elihu Thomson, president of the American Institute of Electrical Engineers, has, our Paris correspondent writes, arrived at the exhibition, after enjoying a most pleasant stay in England, where hospitalities were extended to him on every hand.

Mr. E. W. Stevenson, the electrical engineer, has just associated himself with the Richmond, S. I., Light, Heat and Power Company, at St. George, of which Mr. Erastus Wiman is the president. Mr. Stevenson is still open for expert and contract work, and has in hand some new work in Brooklyn.

Mr. Frank J. Sprague sailed for Europe last week by German steamer "Saale," seeking, like an Alexander, for Old Worlds to conquer. In other words, while taking a much needed vacation, he will probably introduce his electric railway system into Europe at more than one point. His English patents have just been bought up by a strong company.

The late M. Gaston Plante has bequeathed to the French Academy of Sciences a sum that will admit of the award of a prize of 3,000 francs every second year to some Frenchman who has distinguished himself by a study of the science of electricity. In addition. M. Planté has left his house and large gardens at Bellevue, near Paris, as a place of retreat for poor scientists.

Mr. F. R. Chinnock, the Edison agent for Long Island and New Jersey, is equipping the new steel steamer "General" of the Pennsylvania Company's service, with a dynamo of 150 lights, and a steam plant from the New York Safety Steam Power Company. He is also furnishing the fixtures, which are very elaborate. He is also installing a plant on the new steel boat "Pierpont" of the Brooklyn Union Company, consisting of 100 lights complete, and an Armington & Sims engine He has an order for 250 lights for the Hudson River Chemical Works, Shady Side, N. Y., with New York

safety engine; and for a plant of 600 lights with Buckeye engine, for the Robert Gair Paper Company, of Brooklyn. He is equipping two large carousels at Coney Island with 100 lights each, and with electric motors, for Charles Feltman.

MISCELLANEOUS NOTES.

"Electric Sugar."—The Reverend W. E. Howard, who has been on trial in this city for his share in the Friend electric sugar frauds, has been sentenced to eight years and nine months imprisonment with hard labor.

St. Paul, Minn.—The City Council has been recommended by the Committee on Streets to allow the Dorsett system of conduits to be finished, and not to grant any other such privileges, at least until the Dorsett system shall have been proved a failure.

Pole Cutting has been going on actively the past week in New York around the City Hall and the Post Office. Substitute wires for part of the electric service had already been provided in the subways, but there has been great inconvenience and annoyance.

The Universal Electric Railway Signal Company has been incorporated at Richmond, Va., with Robert G. Cabell, Jr., president, and James R. Branch, secretary, to manufacture electric railway signals. The capital stock is to be not less than $100,000 nor more than $500,000.

Magnetic Separation of Ore.—Mr. Josiah T. Smith, in his address as president of the British Iron Trade Association, referred to the fact that magnetic separation has been resorted to in some parts of the American continent, with a view to eliminating from impure ores the deleterious ingredients that unfit them for the production of high-class metal. This, he said, would be another factor in fixing the probabilities of the future of the iron ore trade that must not be lost sight of.

Paris Exposition Jury.—The following are the members of the jury of the electrical section for the Paris Exhibition: MM. Fontaine (Société Gramme), Fribourg (Government telegraphs), Huet (sous-directeur of works of Paris), Mascart (membre de l'Institut), Postel-Vinay (engineer), Potier (professor at l'Ecole Nationale), Sciama (director of the firm of Breguet), Sébert (colonel, director Marine laboratory), Trotin (post and telegraph office). Supplementary members: MM. Jousselin (P. L. M. Railway), Rau (Edison Company), Sautter (Sautter-Lemonnier & Co).

BUSINESS NOTICES.

Chas. A. Schieren & Co., New York, are the patentees and sole manufacturers of the perforated electric leather belting. The perforations obviate air cushions; hence belts run slack with less strain on bearings, and without slip.

The Jenney Electric Company, of Indianapolis, Ind., write: *Messrs. Chas. A. Schieren & Co., 51 Ferry street, New York City.*

GENTLEMEN: We have used your belts for several years with good results. Your perforated electric belt is, however, much more satisfactory. There is less slipping and strain on the bearings.

Please send to our address, Marietta, O., two 9-in. double, endless perforated belts. Length in clear, 45 feet. Yours truly,

JENNEY ELECTRIC COMPANY.
BRAINARD RORISON, Secretary and Manager.
CHAS. A. SCHIEREN & CO. (Manufacturers), New York, Chicago, Boston and Philadelphia.

Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws cap and set screws, all kinds of bolts, taps, files, twist drills, bras and rubber tubing, brush copper, rod and sheet copper, brass rod sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

American Ozokerite.—The attention of electricians, manufacturers of insulated wire and electrical instruments of all kinds, manufacturers of lubricants, and all others using paraffine wax, beeswax or other similar substances is called to ozokerite, discovered in this country by Mr. Jacob Wallace some years ago in the mountains of Utah. Thorough tests and experiments have been made, and this mineral wax found to be equal or superior to the best paraffine and waxes for almost all purposes. After these investigations Mr. Wallace had such unbounded confidence in ozokerite that he organized a company with a capital stock of $1,250,000. He has introduced ozokerite among the leading electrical concerns of the United States, as well as among a large number of other concerns that are utilizing ozokerite for the improvement of their specialties. Ozokerite can be made into a paste, paint or cement. It can be vulcanized in combination with rubber. For the interior lining of vessels holding acids there is nothing superior to it. It can be formed into battery cells and used in all kinds of electrical appliances, and is valuable for coating insulated water-proof wire. A large number of electrotypers are using ozokerite instead of beeswax in taking impressions for plates. Many of them prefer it even at the same price, although the cost of ozokerite is only one-third that of beeswax. The property of the company is extensive in area and has already been proven rich in the mineral. Full particulars and all information will be given at the office of the company, No. 155 Stewart Building, 280 Broadway, New York.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED JUNE 11, 1889.

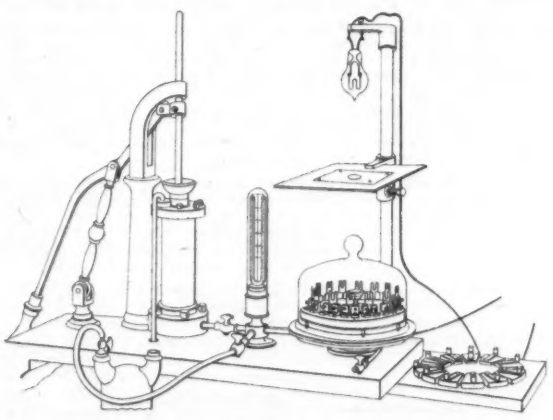
404,816. Incandescent Lamp; Charles A. Backstrom, of New York, N. Y. Application filed March 6, 1889. In combination with an incandescent electric lamp and the filament thereof, a spiral standard for the support of the filament attached to the base of the lamp, made of glass and axially disposed therein.

404,822. Induction Coil; Fred. H. Brown, of Fort Worth, Tex., Assignor to the Magneto Telegraph Company, of New York. Application filed Sept. 23, 1885. The combination of the core, the primary and secondary coils wound thereon, and means for bringing the poles of the core toward or from each other.

404,859. Regulation of Alternating Electric Current Generators; Gustav Pfannkuche, of Cleveland, O., Assignor to the Brush Electric Company, of same place. Application filed Nov. 9, 1887. In a system of electrical distribution, the combination of one or more alternating current dynamos and a separate exciting dynamo having two sets of field magnet coils, one set being included in circuit with the field coils of the alternating current generator, and the other set included in the secondary circuit of an inductorium, the primary of which is in a multiple arc branch of the main line.

(1) 404,861. Method of Indicating the Strength of the Current in an Electric Circuit; (2) 404,860. Apparatus for Indicating the Strength of the Current in an Electric Circuit; Gustav Pfannkuche, of Cleveland, O., Assignor to the Brush Electric Company, of same place. Applications filed Dec. 15, 1888. For description see page 358 of last issue.

(1) 404,866. Electric Signal for Engine Shafts; (2) 404,867. Electric Indicator for Engine Shafts; James C. Ricketson, of Milwaukee, Wis. Applications filed (1) Oct. 4,



405,239. APPARATUS FOR THE MANUFACTURE OF INCANDESCENT LAMPS.

1888; (2) Jan. 26, 1889. In an electric signal for engine shafts, the combination of a revolving shaft and a two-sided or double cam attached thereto, with a pair of push buttons electrically connected to distant signals, and a pin adapted to be moved by the cam to actuate the push-buttons.

404,873. Electric Railway; Sidney Howe Short, of Denver, Col., Assignor to the United States Electric Company, of same place. Application filed Feb. 16, 1887. In an electrical railway in which the motors are run in multiple arc, the combination of a generator, a conduit, an underground conductor insulated throughout its entire length except at intervals, where it is provided with spring contact arms permanently connected therewith, a current collector traveling in the conduit and adapted for contact with the spring arms, a car, a motor on the car, and means for moving the collector with the car.

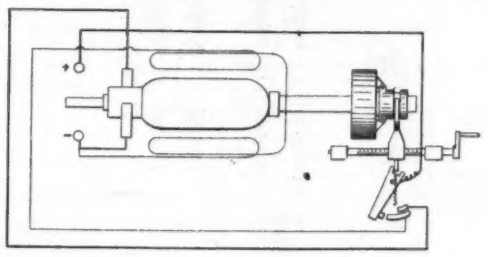
404,877. Underground Conductor; Georges E. Tailleur, of Schenectady, N. Y. Application filed Oct. 25, 1888. A series of brackets for supporting the cables, formed of non-conducting material and designed to be bound together for the accommodation of one or more cables.

(1) 404,893. Elevating Machine; (2) 404,894. Electrically Controlled Engine; (3) 404,895. Electric Elevating Machine; (4) 405,010. Electrically Controlled Engine; James Edwin Byrne, of Brooklyn, N. Y. Applications filed (1) Aug. 10, 1888. (2) Dec. 24, 1888. (3) Jan. 5, 1889. (4) April 19, 1889. (1) The combination, in an elevating machine, of a winding drum and two electric motors, one for hoisting and the other for lowering, connected through a train of mechanism, consisting of a worm shaft, a worm, a worm wheel and a drum shaft. (2) Details. (3) The combination, in an elevating machine, of an electric motor and a winding drum connected by a train of mechanism, a reversible switch in the elevator car, top and bottom and intermediate automatic stop switches on the machine, a battery and suitable electric connections between the machine motor, car switch, automatic switches and battery. (4) The invention consists in the combination with the controlling valve of an ordinary hydraulic elevator of an auxiliary cylinder provided with electrically operated valves, an electric generator, a switch arranged in the elevator car for directing a current through the magnets of the valve, and automatic circuit controllers attached to the hoisting mechanism of the elevator for shifting the circuits and operating the valves when the elevator car reaches the upper or lower end of its excursion.

404,902. Electrical Distribution System; Thomas A. Edison, of Menlo Park, N. J. Application filed Oct. 4, 1881. In an underground system of electrical distribution, the combination with a street intersection box having pipe openings in its sides, of two or more pairs of conductors, each pair forming the two sides of a circuit, pipes for the separate conductors entering the box, and connections within the box of conductors of the same polarity.

404,913. Insulated Electrical Wire; Henry W. Jones, Jr., of New York, N. Y. Application filed March 3, 1889. A wire for conducting electricity, having an insulating covering of strips of compressed asbestos united at the meeting edges by cementing material.

404,968. Method of Distributing Electricity by Secondary Batteries; William W. Griscom, of Haverford College, Assignor to the Electro-Dynamic Company, of Philadelphia, Pa.



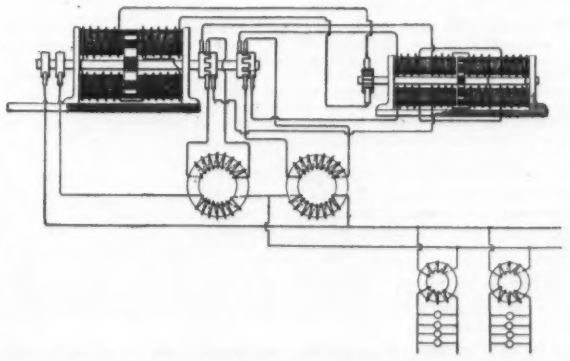
405,223. ELECTRIC MOTOR STARTING AND STOPPING DEVICE.

Application filed Feb. 1, 1889. Consists in generating electricity at or near a suitable source of power, conveying it to the point of consumption through the medium of a current of comparatively low intensity, there storing in the form of chemical energy, as in a secondary battery, and then simultaneously directing the current from the generator and storage apparatus into a working circuit containing translating devices consuming current at a rate exceeding the capacity of the storage apparatus alone.

405,002. Brush Holder for Dynamos; Walter S. Bishop, of New Haven, Conn. Application filed Dec. 6, 1888. The invention consists in a rocking arm provided with a socket for receiving the commutator brush, a spring-supporting arm adjustable on the pivot of the brush-holding arm, the spring-supporting arm and brush-holding arm being provided with sockets for receiving the ends of a spiral spring for pushing the brush forward into contact with the commutator cylinder and an adjusting screw for moving the commutator brush backward and forward through the brush socket.

405,045. Magnetic Machine for Removing Mineral Substances from Grain; Martin L. Mowrer, of Dayton, O. Application filed July 14, 1888. The invention consists in the construction and arrangement of a series of magnetic wheels in a grain spout or chute for removing particles of iron, steel or other mineral substances from the grain during its passage through the spout.

405,089. Electric Self Winding Clock; James H. Gerry, of Brooklyn, Assignor to the Self Winding Clock Company, of New York, N. Y. Application filed March 21, 1889. The combina-



405,174. REGULATION OF ALTERNATE CURRENT GENERATORS.

tion of a clock train, a main spring for actuating the same, an electro magnet, an armature therefor, the latter being arranged to turn upon an axis parallel with the pivots of the clock train, a lever attached to the armature and engaging with the wheel connected with the mainspring a segment or lever, springs, an extra wheel upon the main shaft of the train, and operated by the wheel.

405,124. Discharge Device for Electrical Machines; Albert Schmid, of Allegheny, Assignor to the Westinghouse Electric Company, of Pittsburgh, Pa. Application filed March 12, 1889. The combination, with an electric machine, its belt wheel and a belt applied thereto, of an adjustable discharge device consisting of a discharge plate directed towards the belt-wheel, a support therefor, and means for adjusting the vertical position of such support. See illustration.

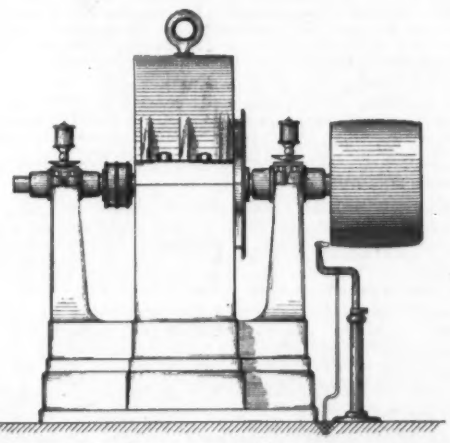
405,126. Automatic Gas Lighting and Extinguishing Apparatus; Nathanial H. Shaw, of Somerville, Mass., Assignor to the American Automatic Gas Lighting Company, of Portland, Me. Application filed May 14, 1888. In a gas lighting apparatus the combination of a rotary burner and gas cock with yielding electrodes, the burner adapted in its rotation to make and break electrical connection through the electrodes.

405,170. Manufacture of Filaments for Electric Lamps; Hiram S. Maxim, of Brooklyn, Assignor to the United States Electric Lighting Company, of New York, N. Y. Application filed Jan. 14, 1881. Patented in England Feb. 15, 1881. The improvements in the art of equalizing the illuminating power of the carbonized conductors of incandescent lamps, which consists in electrically heating the conductors in the presence of a hydrocarbon or equivalent vapor until their electrical resistance and illuminating power for a definite intensity of current have been brought to a predetermined standard.

405,174. Regulation of Alternating Electrical Current Generators; Gustav Pfannkuche, of Cleveland, O., Assignor to the Brush Electric Company, of same place. Application filed Nov. 30, 1887. In a system of electrical distribution, the combination, with an alternating current dynamo and a separate exciter, including the field magnet coil of the alternating current generator and provided with two separate sets of field magnet coils of induction apparatus included in the main line of the alternating current generator, and in a branch from the same for energizing the separate sets of coils on the field magnets of the exciter. See illustration.

405,176. Electrode for Electro Therapeutic Body Wear; Harry P. Pratt, of Chicago, Ill. Application filed March 12, 1889. An electrode comprising a metallic plate enveloped in a close fitting cover of flexible absorbent material.

405,194. Electro Magnetic Transmitter; John T. Williams, of Mount Vernon, Assignor to the International Portelectric



405,124. DISCHARGE DEVICE FOR ELECTRICAL MACHINES.

Company, of New York, N. Y. Application filed Dec. 27, 1888. For description see THE ELECTRICAL WORLD, May 4, 1889.

405,196. Galvanic Battery; John A. Barrett, of Brooklyn, N. Y., Assignor to the John A. Barrett Battery Company, of Baltimore, Md. Application filed April 5, 1889. The invention consists in the employment for a chloride of silver battery of a solution of sulphate of zinc.

405,211. Quadruplex Telegraphy; Charles D. Haskins, of Brooklyn, New York, Assignor to the Western Electric Company, of Chicago, Ill. Application filed Nov. 19, 1887. Consists in providing an extra electro-magnetic device to the neutral relay in circuit with an extra helix provided on the neutral relay magnets. The current induced in the extra coil or helix serves to energize the extra electro-magnet, so that the armature lever of the neutral relay, instead of falling away or kicking, is held in position by the extra electro-magnet and armature.

405,213. Secondary Battery; Thomas H. Hicks, of Detroit, Mich., Assignor to the Hinds Induction Light and Motor Co., of Michigan. Application filed Aug. 2, 1888. A storage battery consisting of two dissimilar bodies, one consisting of a perforate and an imperforate lead plate, inclosing a body of spongy lead between them, and the other consisting of carbon or its equivalent.

405,218. Dynamo Electric Machine; Osborn P. Loomis, of Somerville, Mass. Application filed Jan. 31, 1889. A dynamo electric machine, consisting of two sets of shunt magnets diametrically opposite-like poles being connected to a common pole-piece and having the outer ends of the opposite magnets of each set connected together by yokes, and series coils wound upon said yoke or yokes, so as to generate a counterbalancing field of force and prevent the polar line from shifting.

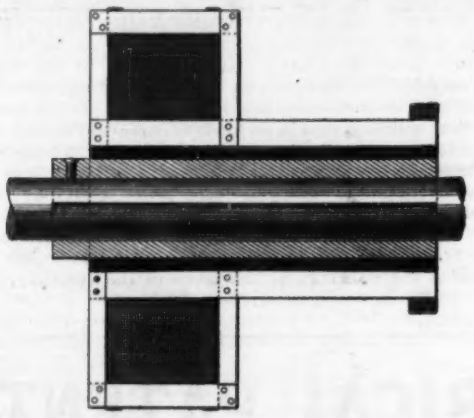
405,221. Testing Apparatus for Switch-Boards; William E. McKivitt, of St. Paul, Minn., Assignor to the Western Electric Company, of Chicago, Ill. Application filed Dec. 18, 1888. The invention consists in the combination, with the operator's telephone outfit, of a key in the circuit connecting with a pair of cords, the clearing out annunciator, the circuit closer operated by the shutter of the drop, and a branch circuit around the key.

405,223. Electric Motor Starting and Stopping Device; Frank A. Perret, of Brooklyn, N. Y., Assignor to the Elektron Manufacturing Company, of New York. Application filed Feb. 6, 1889. The invention consists in interposing a tight or loose pulley, friction clutch, or other form of power-transmitting device between the motor shaft and the work, or between the countershaft operated by the motor shaft and the work, and arranging

this in operative connection with an electrical switch, so that the motor can be connected with its work only by moving the belt shifter, clutch, or other power-transmitting apparatus manually, and the moving device for such purpose will close in succession, first, the field circuit of the motor, and, secondly, the armature circuit. See illustration.

405,235. Municipal Signal Apparatus, John C. Wilson, of Boston, Mass., Assignor to the Municipal Signal Company, of Portsmouth, N. H. Application filed Aug. 24, 1885. In a municipal signal apparatus comprising a main station and one or more sub-stations connected by an electric circuit, a multiple signal-transmitting apparatus and a signal-receiving instrument at the sub-station, and a signal-receiving instrument and a signal-transmitting apparatus at the main station, combined with an electro-magnet for effecting the operation of said signal-transmitting apparatus at the main station, a circuit wheel, for changing the condition of the circuit of said electro-magnet, and a circuit-controlling switch also included in the circuit.

405,239. Apparatus for the Manufacture of Filaments for Incandescent Lamps; Hiram S. Maxim, of Brooklyn, N. Y. Application filed Feb. 21, 1881. The combination with an



405,602. DYNAMO-ELECTRIC MACHINE OR MOTOR.

electric circuit and an air pump, two or more carbon holders or clips arranged under a common receiver suitably supplied with a hydro-carbon or equivalent gas. See illustration.

PATENTS ISSUED JUNE 18, 1889.

405,246. Galvanic Battery; William A. Childs, of Englewood, N. J. Application filed Feb. 6, 1888. The invention consists essentially in forming the battery elements or the plate or rod constituting a continuation of the same with a taper at the points where it passes through the perforation in the battery cover.

405,248. Electric Switch; Olof Dahl, of Brooklyn, N. Y. Assignor to the Cleveland Motor Company, of New York, N. Y. Application filed Oct. 10, 1888. A skeleton frame of general rectangular shape having an opening at the top and bottom and single openings in two of its sides, in combination with a series of contact plates located in a parallel position and extending through the openings in the sides. See illustration.

405,249. Electric Meter; Olof Dahl, of Brooklyn, N. Y. Application filed March 7, 1889. Generally speaking, the meter consists of a thermo-magnetic motor driven by aid of the heat generated in a suitable heating conductor through which the current passes proportionately as the number of translating devices using current combined with loading devices, and apparatus for registering the revolutions of the motor.

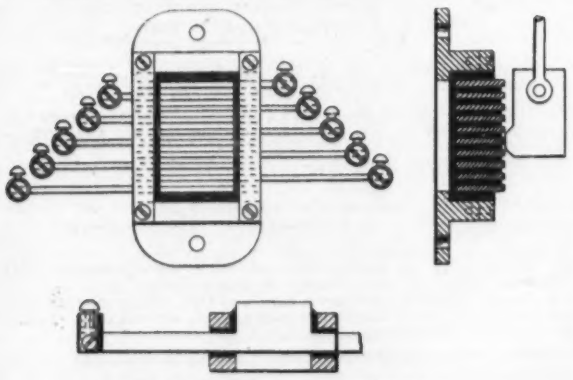
405,263. Compound Wound Alternating Current Dynamo; Hermann Lemp, of Lynn, Mass. Application filed March 2, 1889. The invention consists, essentially, in passing an exciting current through the same field magnet coil, both from the main circuit coil of the machine or that which supplies current to the work and from a separate exciting source, which latter is preferable for the sake of simplicity, on the same armature or in the same field with the work circuit armature coil, although it may be an entirely separate machine. See illustration.

405,284. Dynamo Electric Machine; Frank Thone, of Oskaloosa, Iowa. Application filed Oct. 22, 1888. An armature consisting of a core and longitudinally wound coils of copper wire encompassing the same, the core consisting of annular heads or end pieces, longitudinal bars connecting said heads, but electrically insulated from one of them, and circumferential windings or wrappings of iron.

405,334. Friction Generator; Henry E. Waite, of New York, N. Y. Application filed Feb. 25, 1889. In a friction generator the combination, with a case, of bearings mounted upon the outside of the case, a shaft carrying one or more plates supported in said bearings, and hollow shafts mounted upon the first shaft and carrying other plates.

405,345. Process of Electric Welding; Charles L. Coffin, of Detroit, Mich. Application filed Dec. 20, 1888. The process of electric welding, consisting in feeding metal to the joint through the welding arc from a supply carried on the welding tool.

405,365. Electric Railway; Alexander L. Lineff, of Westminster, Assignor of one-half to Edward Hodson Bayley, of El-



405,248. ELECTRIC SWITCH.

tham, England. Application filed July 10, 1888. Patented in England Oct. 4, 1887; in France, April 4, 1888, and in Belgium, April 4, 1888. In an electrical tramway or railway the combination of a trailing collector of electricity suitably connected to the car or carriage, with an electrical conductor made up of insulated metallic sections electrically and flexibly connected and provided at convenient distances apart with rubbing pieces having a cross section corresponding to the section of the collector, and against the whole rubbing surface of which the collector rubs as it is dragged along.

405,382. Telephone Switch; Alfred Stromberg, of Chicago, Ill., Assignor to the Western Electric Company, of same place. Application filed April 4, 1887. The combination with the bell-crank lever, which forms the telephone support of a flat bent spring, one end being fixed, the free end of said spring pressing against one of the arms of the support and vibrating between the fixed opposite contacts of the switch to alternately change the connection of the spring from one side to the other as the telephone is placed upon and removed from the support.

405,399. Electric Meter; Rudolph Diehl, of New York, N. Y., and Philipp Diehl, of Elizabeth, N. J. Application filed Feb. 21, 1889. In an electric meter, the combination of a train of wheels and indicating dials, a friction clutch applied to one of said wheels, means for giving regular impulses to a lever operating upon said friction clutch, a solenoid in the translating circuit, a moveable core therefor, mechanism connected with said core, which governs the extent of motion of said friction clutch, whereby variable motion is given to the wheels according to the position of the core.

405,420. Attachment for Telephones; Hermann Konigslow, of Cleveland, O. Application filed Jan. 7, 1889. With this improvement, one step upon a treadle in connection with the ringing apparatus is all that is required to enable a person to be in telephonic communication in answer to a call. The moment the treadle is depressed the apparatus is automatically reconnected with the exchange office and ready for use.

405,436. Electro-Medical Belt; William J. Shelton, of Columbia, Texas. Application filed Sept. 15, 1888. The invention consists in a suitable belt carrying movable contact plates, a galvanic battery, an induction coil, connections between the battery and coil, and conductors connecting the secondary wire of the coil to the contact plates through which the shock is to be conveyed, the contact plates being provided with suitable binding-screws or other connectors, and also having suitable flues or insulators for covering them when not in use.

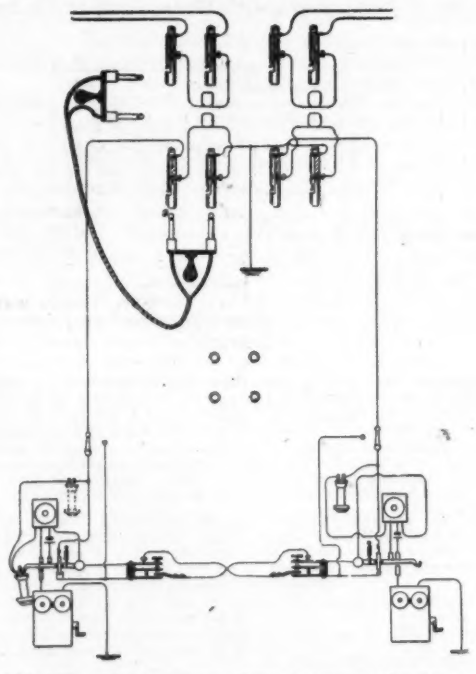
405,440. Electric Arc Lamp; Elmer A. Sperry, of Chicago, Ill. Application filed Oct. 22, 1888. In an arc lamp, the combination of a main circuit electro magnet or solenoid with a moving frame, on which it is supported, a carbon rod-clamping device moved by the electro-magnet or solenoid, and a shunt magnet or solenoid adapted to move the frame.

405,441. Dynamo; Elmer A. Sperry, of Chicago, Ill., Assignor to the Sperry Electric Company, of same place. Application filed Feb. 11, 1889. In a dynamo electric machine, the combination of a rotating spider with a series of bolts projecting therefrom and secured thereto and an armature secured on such bolts independently of the spider.

405,452. Apparatus for the Electrolysis of Lead; Charles O. Yale, of Rome, N. Y., Assignor of one-half to Moses M. Davis, of same place. Application filed March 8, 1886. He attains the separation and purification of the lead from the other constituent elements which enter into the base bullion, by employing in series a system of decomposing vats circular in form, with a core in the centre composed of non-elastic conducting material, inclosing the permanent conductor in the core and vat, in which the base bullion is subjected to decomposition by electrolysis in a solution having the proper electrolytic elements. The decomposing efficiency of the electric current which passes through the series of vats will deposit an equivalent of metal in each vat.

405,461. Metallic Telephone Circuit; Henry L. Burbank, of Jersey City, N. J., Assignor to the American Bell Telephone Company, of Boston, Mass. Application filed March 13, 1889. The object of the invention is to obtain the benefits accruing from the use of metallic circuits, and to reduce the costliness of such circuits by making each double wire circuit subserve as the conducting medium for two or more sub-stations, and to do this while providing that each station shall, when using the line for telephonic conversation, have a clear line unencumbered by interposed electro magnets, that each station shall be enabled to ascertain when the circuit is already being used by another, and that while any one station is using the line none of the others shall be able to disturb the conversation by sending a signal call.

405,468. Street Cable Railway; Henry Flad, of St. Louis, Mo. Application filed Sept. 2, 1887. The invention consists in



405,677. TELEPHONE COMBINATION CIRCUIT.

the combination, with a track and a car carrying a grip, of a motor for actuating a cable, a permanently charged electric conductor located along the line of railway and means for admitting power to the motor controlled by an electric circuit which may be established or broken at pleasure.

405,471. Apparatus for Generating Electricity; Timothy Gleason, of Brooklyn, N. Y. Application filed July 25, 1888. An apparatus for generating electricity, consisting of a vibrating magnet and a soft iron core supported above the magnet and surrounded by an insulated coil.

405,480. Manufacture of Carbon Filaments; Theophilus Vaughan Hughes, of Holywell, North Wales, and Charles Ronald Chambers, of South Kensington, County of Middlesex, England. Application filed Aug. 30, 1886. The invention consists in the method of manufacturing carbon filaments by the destructive distillation of a gaseous carbon compound capable of yielding carbon when decomposed by heat, whereby is obtained fine hair-like filaments which undergo no appreciable change in the homogeneity during the subsequent process of lamp-making as almost all of the hydrogen has been eliminated during their formation.

405,507. Dynamo Electric Machine; William Danton Sandwell, of Herne Hill, County of Surrey, England. Application filed Feb. 13, 1889. Patented in England Oct. 25, 1887; in Germany March 14, 1888; in Belgium March 30, 1888; in France March 30, 1888; in Italy June 30, 1888; in Spain July 13, 1888; in Austria-Hungary Aug. 9, 1888, and in Canada Feb. 14, 1889. In an electric motor, the combination, with the field magnets, of two armatures, the said magnets and armatures being the one movable with respect to the other.

405,515. Pilot or Head for Sectional Rods for Threading Underground Conduits; George H. Warde, of New York, N. Y., Assignor to William Hampden Johnstone, of Philadelphia, Pa. Application filed April 19, 1889. In an apparatus for threading conduits the pilot or head having spring-actuated jaws tending to open, curved inwardly upon their exterior faces near their forward ends, and provided with anti-friction rollers.

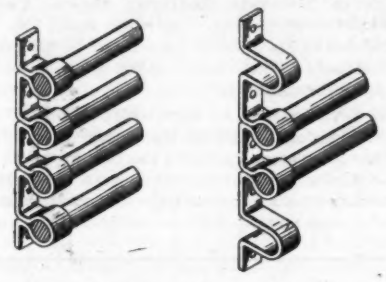
405,519. Electric Appliance for Railway Switches; Morris Wuerpel, of St. Louis, Miss. Application filed April 30, 1888. The combination of two moving rails of a railroad switch, a block moved by each rail into contact with another block, wires connecting both of the blocks with one pole of a galvanic battery, wires connecting the other blocks with the coils of different electro-magnets, both of which have electric connection with the other pole of the electric battery, and an armature common to both magnets connected with an indicating finger, all arranged so that the circuit will be closed whether the switch is open or closed, and thus show by means of an indicating device the position of the switch rails.

405,525. Electrical Bell Pull; Charles A. Braun, of Chicago, Ill. Application filed March 11, 1889. In combination, with an electric circuit, electric bell, bell pull, and insulated contact point to one end of said circuit, a transversely reciprocating spring chamber provided with an insulated plug operating with said insulated contact point, whereby, by operating said bell pull the electric circuit may be opened and closed.

405,539. Autographic Telegraphy; Mark W. Dewey, of Syracuse, N. Y., Assignor by direct and Mesne Assignments to the Dewey Corporation, of same place. Application filed Sept. 22, 1888. A large field or range of movement of both the transmitting and the receiving pens is obtained, so that a page of writing may be done without moving the paper. The stylus or pen of the transmitter is sustained at the end of the universally jointed arms and is free from strains of springs pulling in certain directions, which interfere with the free movement of the hand in writing, and can be left in contact with the paper in any position without moving. Convenient means are provided for raising and lowering the receiving stylus or pen automatically without raising and lowering the handle of the transmitting stylus or pen in an autographic telegraph actuated by varying strength of current or impulses.

405,544. Contact Device for Electric Railways; Frank E. Fisher, of Detroit, Mich. Application filed Feb. 15, 1889. In an overhead contact for electric railways a traveling contact device adapted to form a contact against the side of the conductor, said contact device being supported upon a yielding horizontal arm pivotally supported at the top of a suitable standard or post, and in connection therewith mechanism for maintaining mechanical contact between the said contact device and the conductor.

405,546. Insulator; Robert P. Frist, of Wilmington, Del. Application filed April 14, 1889. A looped strip is placed over the wire and then pinched together back of the wire, after which it is



405,546. INSULATOR.

secured by fastening devices in position, thus not only rigidly retaining the wire in position but also maintaining it a certain distance from the wall or other supporting surface, portions being interposed between said surface and the wire, so as to effectually insulate the latter. See illustration.

405,556. Electric Railway; Rudolph M. Hunter, of Philadelphia, Pa. Application filed Feb. 25, 1889. In an electric railway, a branching conductor arranged along and parallel to a branching railway, in combination with a movable conductor switch section at the point of branching to guide the collector of the motor upon either branch track desired, two electric light signals of different colors, one for each branch track, two electric circuits, one for each of said lamps, and circuit breakers controlled by the movement of the switch section.

405,566. Telephone Attachments; Otto Konigslow, of Cleveland, O. Application filed Oct. 27, 1888. The combination of jointed arms of unequal length, a spring for folding the arms, the shorter arm being mounted upon a trunnion to turn in a vertical plane, the longer arm having a telephone receiver attached to the free end thereof, whereby the gravity of the receiver, when left free, tends to turn the arm to a vertical position.

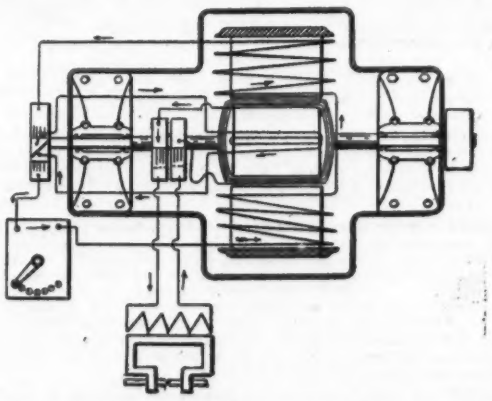
405,572. Ground Detector for Electric Circuits; Osborn P. Loomis, of Somerville, Mass. Assignor to the Loomis Electric Manufacturing Company, of New York, N. Y. Application filed March 11, 1889. The invention consists in a normally grounded detector line or wire connected across to the respective sides of the main line and including in its circuit a differentially wound electro-magnet, the armature which is arranged to control a suitable ground signaling device, which is caused to give a signal, audible or visual, by the differential action in the magnet consequent upon accidental grounding of either side of the main line.

405,576. Electric Wire Conduit; John Lynch, of Washington, District of Columbia. Application filed Oct. 1, 1887. Conduit for electric wires comprising a series of superimposed sections, consisting each of a base recessed at its corners and side and central vertical ribs, the former having upper curved edges.

405,602. Dynamo Electric Machine or Motor; Conrad L. Rosenqvist, of Yonkers, N.Y. Application filed Feb. 13, 1889. The armature is of the Gramme type, and it consists of a core of iron wire, around which flat copper strips representing the coils, are placed. The copper strips of each turn or convolution are four in number, and are arranged in a rectangular shape, with their extremities riveted together. The inner strip, or the one which runs parallel to the shaft, is extended to form a segment of the commutator. See illustration.

405,609. Galvanic Battery; James Serson, of Boston, Mass., Assignor to the Potter-Compton Electric Company, of New York, N. Y. Application filed March 5, 1889. In an electric battery the combination of a retaining jar, a porous cup supported on legs within said jar, two detachable foraminous cylinders within said cup and a porous jar within said cylinders.

405,621. Key; Clarence Wallace Taylor, of Janesville, Wis. Application filed Sept. 27, 1888. The combination, with a telegraph instrument, of a vibrating lever mounted therein, a sliding plate having a longitudinal slot carried on the lever, a weight suspended



405,263. COMPOUND WOUND ALTERNATING CURRENT DYNAMO.

from the sliding plate and provided with a longitudinal slot, and a set-screw adapted to pass through the slot in the sliding plate and into the lever to retain said plate at any desired adjustment.

(1) 405,626. Slotted Conduit for Electrical Conductors; (2) 405,627. Switch for Suspended Electric Conductors; Charles J. Van Depoele, of Lynn, Mass. Applications filed (1) June 6, 1888; (2) Feb. 19, 1889. (1) A conduit for electrical conductors, comprising an exterior casing having side walls of insulating material, yokes for supporting and sustaining said side walls, supports arranged within the conduits and attached to the insulating side walls, and conductors secured to said supports. (2) A switch for electric conductors, comprising a rib or member for each conductor, the inner extremities of which are arranged to intersect or lap, and a bridge or body by which said members are connected.

405,628. Closed Slotted Conduit for Electric Railways; Charles J. Van Depoele, of Lynn, Mass. Application filed April 2, 1889. A closed slotted conduit comprising a protective casing formed with a slot along its upper side, an exterior insulating conductor support, flexible non-conducting slot closing strips adjacent to the edges of the protective casing, and springs behind the strips for holding them in contact to close the slot.

405,668. Electric Motor or Dynamo Electric Machine; Rudolph M. Hunter, of Philadelphia, Pa. Application filed Jan. 28, 1889. In carrying out the invention the armature is wound with coils arranged alternately and with alternate coils coupled to the same commutator, but to different segments and, preferably, the

commutators may be arranged at opposite ends of the armature. The four brushes and field coils are connected with the source of electric supply through a regulator, whereby the two sets of armature coils may be coupled in series or parallel with respect to the source of electric supply.

405,677. Telephone Combination Circuit; Frank A. Pickernell, of East Orange, N. J., Assignor to the American Bell Telephone and Telegraph Company, of same place. Application filed March 13, 1889. The invention comprises a circuit arrangement of a pair, and necessarily, therefore, of any number of pairs of single wire circuits, in which each wire of the said pair or pairs in which quiescent terminated at the earth at its own sub-station, as usual, and is capable of being united at a central station with other single wire circuits while, however, it is also capable of being employed as one member of a metallic circuit of which the other wire of the pair constitutes the other member, the two lines then forming a metallic circuit adapted to be used at will, albeit separately, by the sub-station of either of the said lines which are respectively its component parts, the said metallic circuit being also adapted to be united at the central station with any other metallic circuit similarly or otherwise formed.

PATENTS EXPIRED JUNE 18, 1889.

127,972. Improvement in Electro-Magnetic Regulator for Incubators; Jacob Graves, of Reading, Pa. The improvements consist in so arranging an adjustable bar or spring composed of different metals in connection with the contacts of an electrical battery and the several devices of a heating apparatus as to cause, by the expansion and contraction of the said bar or spring, the electric current to be connected or broken, and the flame of the heating apparatus to be increased or diminished and at the same time the cover of a ventilating device to be opened or closed, so as to instantaneously regulate the temperature within the incubator to a constant degree of heat.

128,081. Improvement in Coating or Electro-Plating Iron, Brass, Copper, etc., with Tin. The process, for the preparation of a bath of tin by adding dried nitro-muriate or nitrate of tin to a solution of cyanide of potassium, for the purpose of precipitating the tin and then washing and draining or drying the resulting precipitate previously to the addition thereto of the sulphuric or muriatic acid.

128,166. Improvement in Metal Pipes and Tubes for Conveying Water, Gas and Other Fluids; Dubois D. Parmelee, of New York, N. Y. A nickel lined pipe of lead, iron, brass or other suitable metal or alloy.

128,094. Improvement in Magnetic Bath-tubs; John R. Anderson, of New York, N. Y. Consists in the arrangement of a metallic plate or frame, capable of being applied to any bath-tub, whether insulated or not, and connected to one pole of a battery while the bath-tub is connected with the other pole, to cause the current of electricity to pass upward or downward, as well as sidewise through the body of the patient operated upon.

128,131. Improvement in Printing Telegraphs; Thomas A. Edison, of Newark, N. J. A chain or cord under control of an electro-magnet and pressed into contact with the surface of the paper to produce a telegraphic character by embossing.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.

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